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DU MONT

# CATHODE-RAY OSCILLOGRAPHS

## TYPES 343 and 345

### Including Du Mont Type 2622 Cathode-follower Adapter

Allen B. Du Mont Laboratories, Inc.
TECHNICAL PRODUCTS DIVISION
760 BLOOMFIELD AVENUE, CLIFTON, N. J., U. S. A.

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ALLEN B. DU MONT LABORATORIES, INC.
TECHNICAL PRODUCTS DIVISION
Clifton, N. J.
U. S. A.

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# DU MONT TYPES 343 AND 345
# CATHODE-RAY OSCILLOGRAPHS
# INCLUDING
# DU MONT TYPE 2622
# CATHODE-FOLLOWER ADAPTER

## OPERATING AND MAINTENANCE MANUAL

Part Number 67025542

Issue 1

ALLEN B. DU MONT LABORATORIES, INC.
TECHNICAL PRODUCTS DIVISION
760 BLOOMFIELD AVENUE
CLIFTON, N.J., U.S.A.

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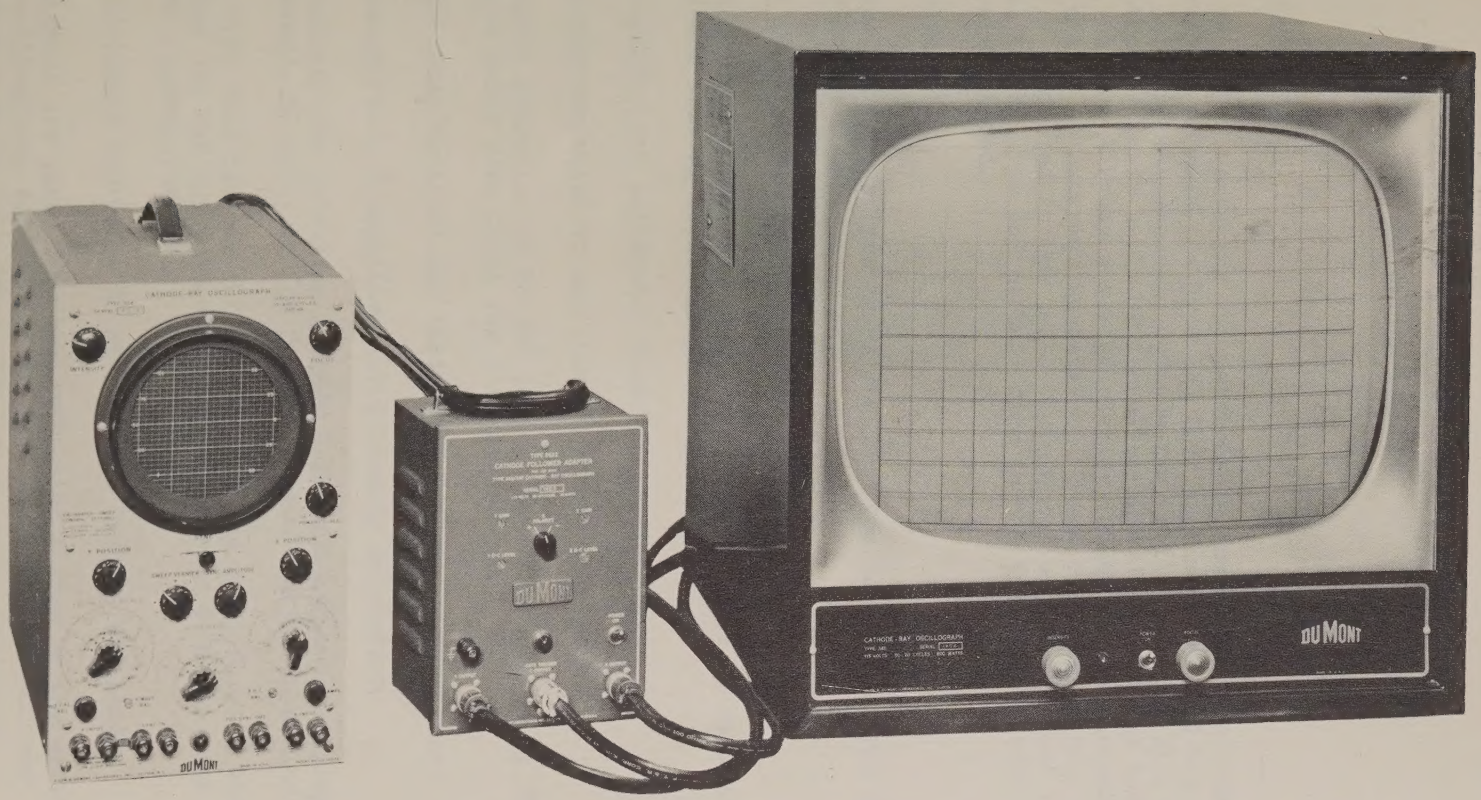
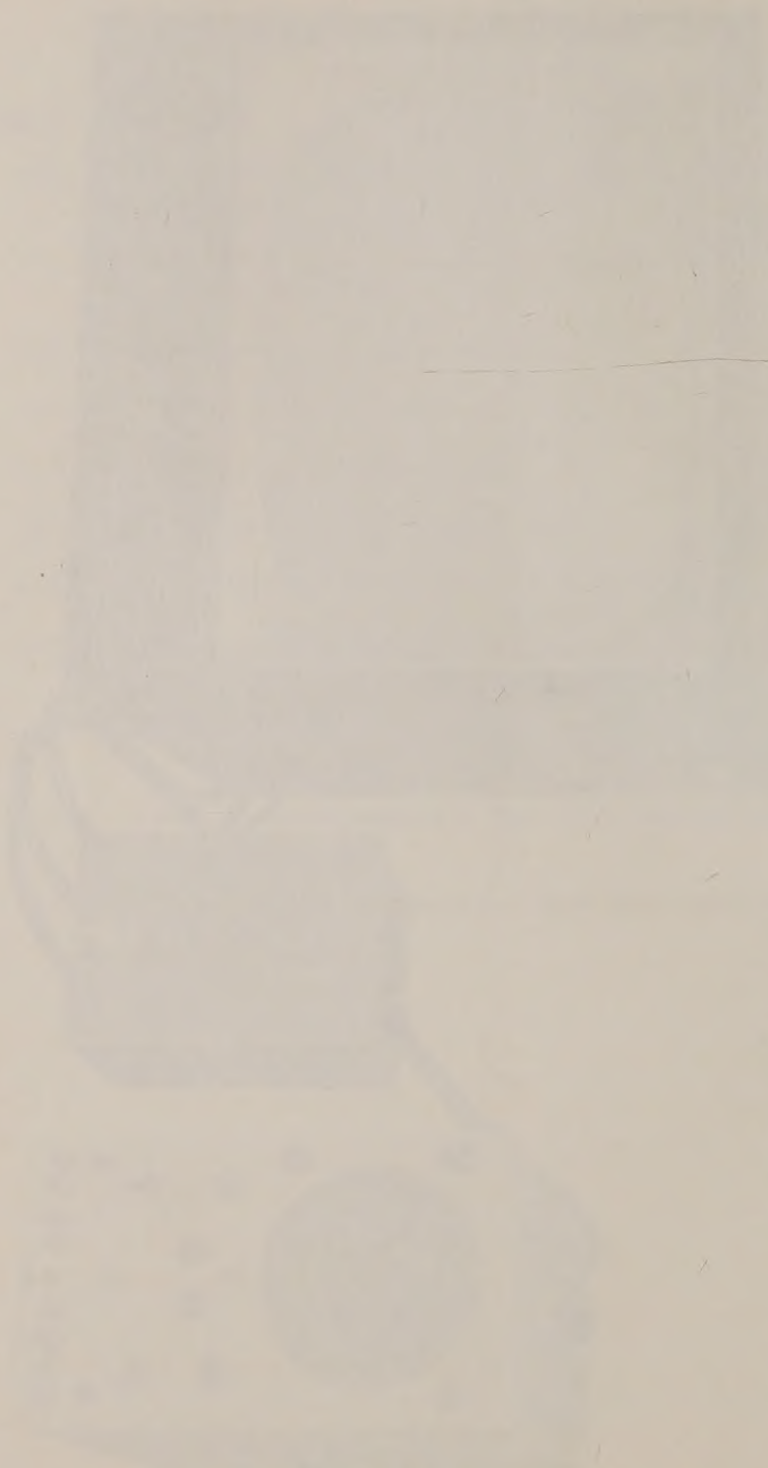



FIGURE 1-1. ILLUSTRATION OF DRIVING OSCILLOGRAPHER, CATHODE-FOLLOWER ADAPTER, AND THE 21-INCH OSCILLOGRAPH



# SECTION 1

# TECHNICAL SUMMARY

## 1-1. INTRODUCTION

This manual of operating and maintenance instructions provides information on both the Type 343 (17" rack mounted) and the Type 345 (21" table model) Cathode-ray Oscillographs. With the exception of their style of installation and cathode-ray tube size, these two types are electrically identical; mechanically they differ in exterior appearance. These differences are clearly indicated in the text. References made throughout this manual to the Type 343 pertain also to the Type 345 unless otherwise stated.

## 1-2. FEATURES

- Type 343 uses a Type 17LP4 and the Type 345 uses a Type 21FP4A Cathode-ray Tube
- P1 or P7 screen phosphors available upon request
- Large screen indicator duplicates every detail of manipulation of the driving oscillograph
- Complete with calibrated mask and safety glass
- Easily connected to any low-frequency instrument
- Remote operation up to 200 feet is possible when using FTR Type K-111 Coax Cable for interconnection
- Identical vertical and horizontal deflection amplifiers
- Incorporates Z amplifier for intensity modulation
- Facility for selection of BEAM GATE (automatic trace brightening), NO GATE, or INT BLANK (internal retrace blanking)
- A Type 2622 Cathode-follower Adapter is supplied with the Type 343 and 345 Cathode-ray Oscillographs complete with 10-foot interconnecting cable
- Additional cables in 25 and 75-foot lengths available
- Signals are taken from the deflection plates of the driving oscillograph, applied to the Type 2622 Cathode-follower Adapter which then drives the large screen indicator

## 1-3. TECHNICAL SUMMARY

Table 1-1 lists the essential characteristics of the Types 343 and 345 Cathode-ray Oscillographs and Table 1-2 lists them for the Type 2622 Cathode-follower Adapter. Refer to Figure 1-2 for a functional block diagram of these units.

TABLE 1-1

TECHNICAL SUMMARY

DU MONT TYPES 343 AND 345 CATHODE-RAY OSCILLOGRAPHS

| | | |
|---|---|---|
| 1. | CATHODE RAY TUBES | |
| | a. Types | 17LP4 used in Type 343<br>21FP4A used in Type 345;<br>P1 or P7 screens supplied on special order |
| | b. Focus | Electrostatic |
| | c. Deflection | Electromagnetic |
| | d. Accelerating Voltage | 6000 volts |
| | e. CRT Mask and Scale | 8 x 12 or 12 x 16-inch scale applied to concave surface of mask. Graduations are spaced one inch apart in both directions |
| 2. | VERTICAL AND HORIZONTAL AMPLIFIERS | |
| | a. Input | Direct coupled, balanced signals |
| | b. Input Impedance | |
| | (1) Grid to ground | 1 megohm, 30 uuf |
| | (2) Grid to grid | 25K ohms, 40 uuf |
| | c. Sensitivity | 1 volt peak-to-peak balanced/inch |

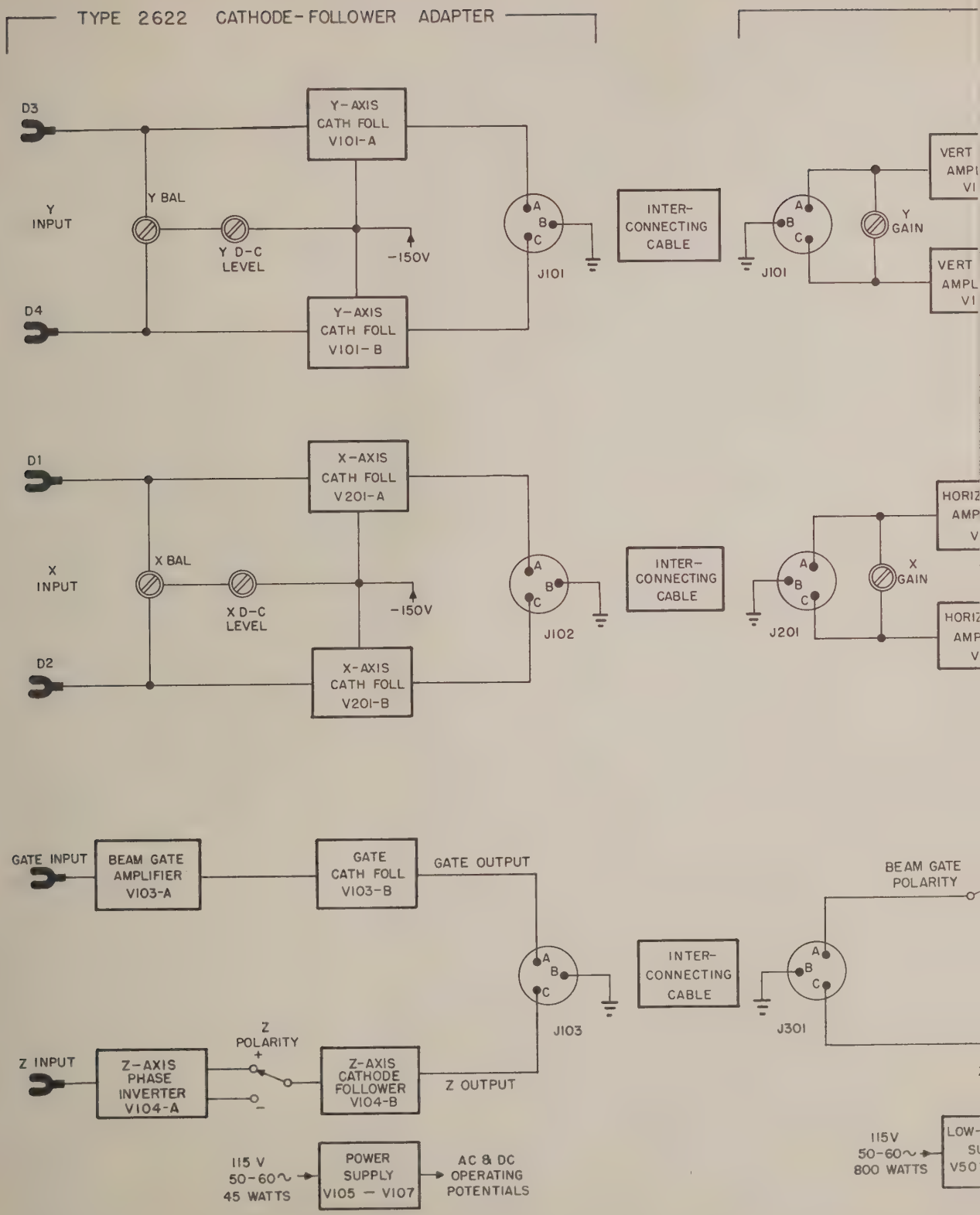



FIGURE 1-2. FUNCTIONAL BLOCK DIAGRAM: TYPE 2622 CATHODE-FOLLOWER

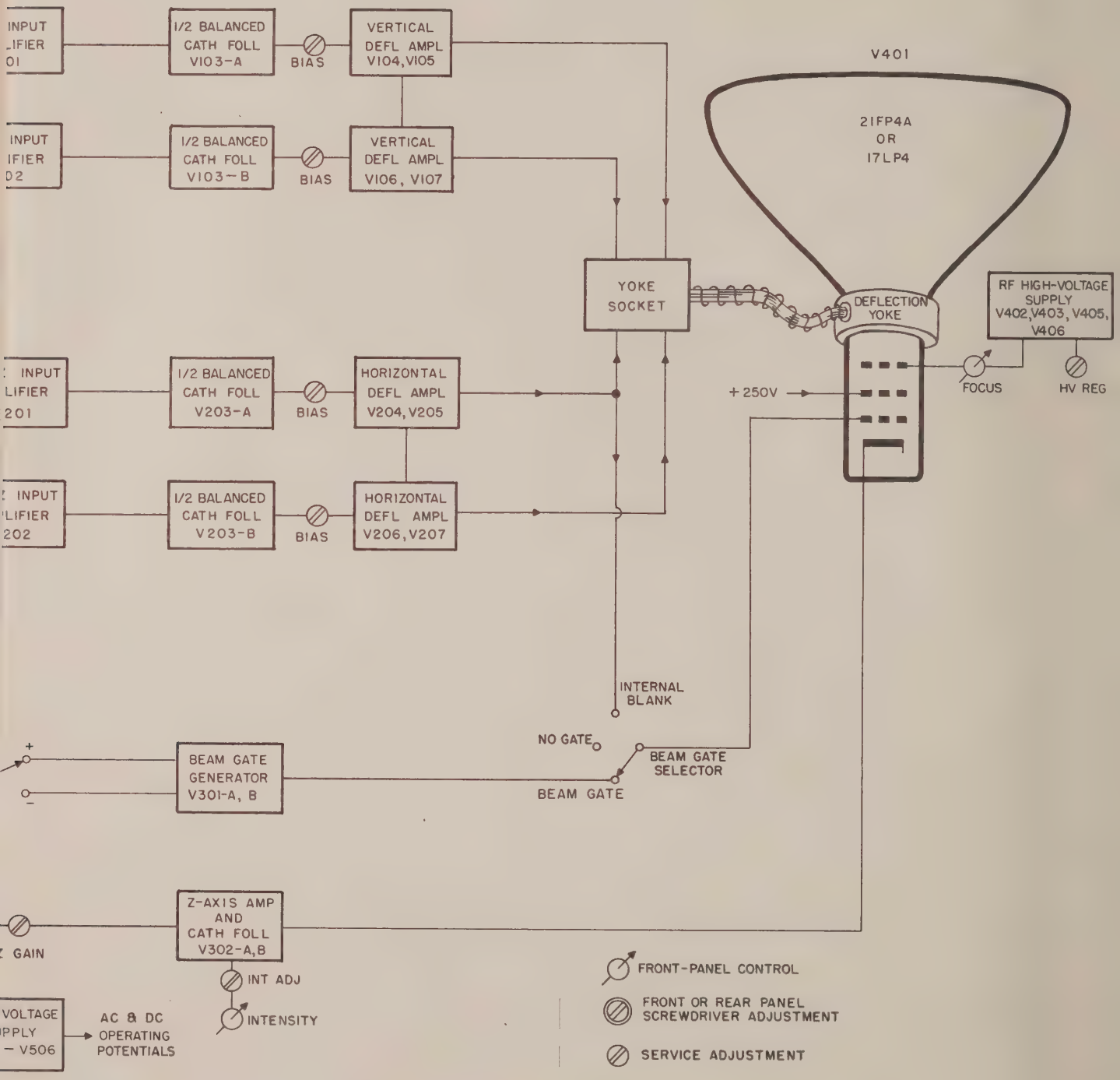

INPUT
LIFIER
01
1/2 BALANCED
CATH FOLL
V103-A
BIAS
VERTICAL
DEFL AMPL
V104, V105
INPUT
IFIER
02
1/2 BALANCED
CATH FOLL
V103-B
BIAS
VERTICAL
DEFL AMPL
V106, V107
V401
21FP4A
OR
17LP4
YOKE
SOCKET
DEFLECTION
YOKE
RF HIGH-VOLTAGE
SUPPLY
V402, V403, V405,
V406
FOCUS
HV REG
+250V
INPUT
LIFIER
201
1/2 BALANCED
CATH FOLL
V203-A
BIAS
HORIZONTAL
DEFL AMPL
V204, V205
INPUT
LIFIER
202
1/2 BALANCED
CATH FOLL
V203-B
BIAS
HORIZONTAL
DEFL AMPL
V206, V207
INTERNAL
BLANK
NO GATE
BEAM GATE
SELECTOR
BEAM GATE
BEAM GATE
GENERATOR
V301-A, B
Z-AXIS AMP
AND
CATH FOLL
V302-A, B
GAIN
INT ADJ
INTENSITY
VOLTAGE
PPLY
V506
AC & DC
OPERATING
POTENTIALS
FRONT-PANEL CONTROL
FRONT OR REAR PANEL
SCREWDRIVER ADJUSTMENT
SERVICE ADJUSTMENT

TABLE 1-1. TECHNICAL SUMMARY (Continued)

| | |
|---|---|
| d. Frequency Response*. . . . . | Extends from dc to the distortion limits**. For 100% full scale, the distortion limit is 20 kc with 80% relative response; for 50% full scale, 40 kc with 70% relative response (3 db); for 30% full scale, 90 kc with 60% relative response. The 3 db point for 30% full scale is 80 kc |

*The data given is for the Type 343. However, if the full scale pattern observed on the Type 345 is restricted to 10 x 15 inches, the above data is applicable for this instrument.

**The distortion limit is that frequency, with a given amptitude, that visible distortion of a sine wave occurs.

| | |
|---|---|
| e. Gain | |
| (1) Vertical. . . . . | A Y GAIN control permits vertical adjustment of observed pattern with respect to driving oscillograph |
| (2) Horizontal... . . . . | A X GAIN control permits horizontal adjustment of observed pattern with respect to driving oscillograph |
| f. Linearity. . . . . | 1% full scale with respect to driving oscillograph, or 5% per inch incremental |
| g. Relative Phase Shift . . . . . | $\pm 4^{\circ}$ maximum up to 10 kc |
| 3. BEAM GATE | |
| a. Availability . . . . . | Beam gate provided to brighten trace during sweep interval. Used with oscillographs in which a sweep gate or trigger is available |
| b. Sensitivity . . . . . | 50 volts peak trigger required |
| c. Polarity Switch. . . . . | Permits use of trigger of either polarity |

TABLE 1-1. TECHNICAL SUMMARY (Continued)

| | | |
|---|---|---|
| 4. | BEAM GATE SELECTOR | |
| | a. Beam Gate | Provides brightening of the trace during sweep forward time |
| | b. No Gate | No blanking when utilizing X amplifier for X, Y plotting |
| | c. Internal Blanking | Provides internal retrace blanking when using oscillographs which do not provide a beam gate |
| 5. | Z AXIS | |
| | a. Z Amplifier | Provides intensity modulation of cathode-ray tube beam |
| | b. Sensitivity | Variable by adjusting Z GAIN control so modulation level is similar to that of driving oscillograph |
| | c. Frequency Response | DC to 3 db down at 80 kc |
| 6. | POWER SUPPLY | |
| | a. Regulated Supply | +250 and -250 volts. Filtered and regulated against changes in load and line voltage |
| | b. Bias Supply | -450 volts to ground unregulated |
| | c. RF High-Voltage Supply | 6000 volts, regulated |
| | d. Power Requirements | |
| | (1) Primary Source | 115 volts ±10% |
| | (2) Primary Frequency | 50 to 60 cycles |
| | (3) Primary Power | 800 watts |

7. SIZE AND WEIGHT

| | Type 343 | Type 345 |
|---|---|---|
| a. Height | 21 inches | 22 inches |
| b. Width | 19 inches | 23 inches |
| c. Depth | 22 inches | 27 inches |
| d. Weight | 120 pounds | 136 pounds |

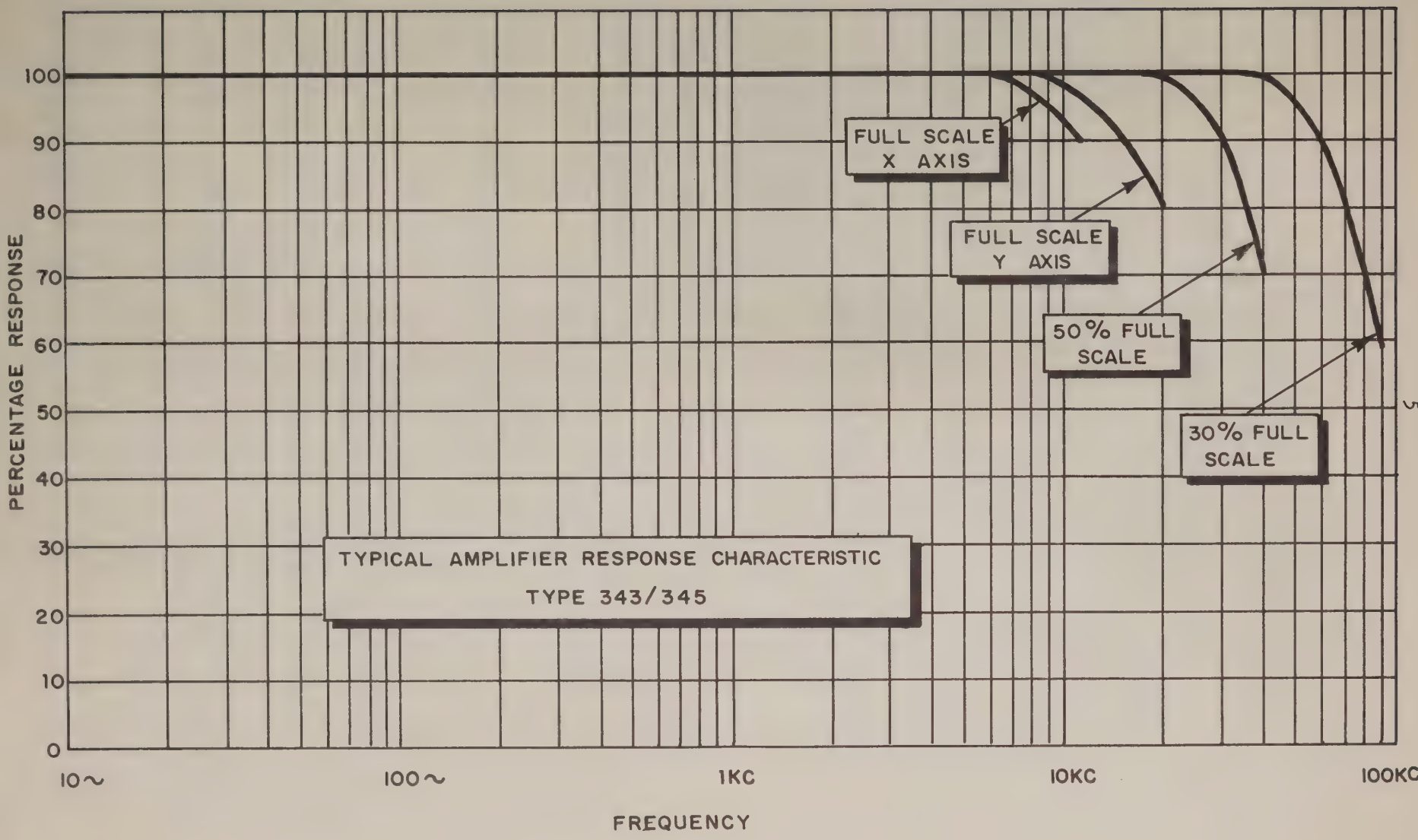

100
90
80
70
60
50
40
30
20
10
0
PERCENTAGE RESPONSE
FULL SCALE
X AXIS
FULL SCALE
Y AXIS
50% FULL
SCALE
30% FULL
SCALE
TYPICAL AMPLIFIER RESPONSE CHARACTERISTIC
TYPE 343/345
10~
100~
1KC
10KC
100KC
FREQUENCY

TABLE 1-2

TECHNICAL SUMMARY

DU MONT TYPE 2622 CATHODE-FOLLOWER ADAPTER

| | | |
|---|---|---|
| 1. | PURPOSE. . . . . | Designed to be used with the Types 343 and 345 Cathode-ray Oscillographs. The Type 2622 Cathode-follower Adapter receives signals from the driving oscillograph, transforming them to an impedance and voltage level suitable for transmission through lengths up to 200 feet of FTR Type K-111 cable to drive the Type 343 or 345 |
| 2. | VERTICAL AND HORIZONTAL CATHODE FOLLOWERS | |
| | a. Input. . . . . | Obtained at the deflection plates of the driving oscillograph, attenuated by a balanced attenuator of 5:1 |
| | b. Input Impedance. . . . . | 8.8 megohms ±2% balanced, shunted by 30 uuf |
| | c. Output Impedance . . . . . | 500 ohms to ground (each cathode) |
| | d. Frequency Response (When driving Type 343 or 345) | |
| | (1) Without interconnecting cable . . . . . | DC to over 1 mc |
| | (2) With 10 feet of cable . . . . | 3 db down at 900 kc |
| | (3) With 200 feet of cable. . . . | 3 db down at 150 kc |
| 3. | BEAM GATE AMPLIFIER AND CATHODE FOLLOWER | |
| | a. Input Impedance. . . . . | 100K ohms in series with 0.01 uf |
| | b. Output Impedance . . . . . | 120 ohms |
| | c. Sensitivity. . . . . | 2.5-volt gate provides 50-volt trigger |

TABLE 1-2. TECHNICAL SUMMARY (Continued)

| | | |
|---|---|---|
| 4. | Z-AXIS PHASE INVERTER AND CATHODE FOLLOWER | |
| | a. Input Impedance | 100K ohms in series with 0.1 uf |
| | b. Output Impedance | 500 ohms |
| | c. Frequency Response (When driving Type 343 or 345) | 3 db down from 10 cycles to 80 kc (any cable length up to 200 feet) |
| 5. | POWER REQUIREMENTS | |
| | a. Primary Source | 115 volts ±10%, single phase |
| | b. Primary Frequency | 50 to 60 cycles |
| | c. Primary Power | 45 watts |
| 6. | SIZE AND WEIGHT | |
| | a. Height | 9-1/2 inches |
| | b. Width | 7 inches |
| | c. Depth | 6 inches |
| | d. Weight | 13 pounds |

# SECTION 2

# INSTALLATION AND OPERATION

## 2-1. INSTALLATION

The installation of the Types 343 and 345 Cathode-ray Oscillographs differ in that the Type 343 is designed to be mounted in a standard relay rack or cabinet and the Type 345 is the table or bench model. Both units may be placed in any convenient viewing place and operated remotely up to 200 feet (cable length limit).

The Type 2622 Cathode-follower Adapter is supplied with leads two feet long, enabling sufficient clearance when making hook-up to the driving oscillograph.

## 2-2. FRONT AND REAR-PANEL FACILITIES

The front and rear-panel markings are essentially self-explanatory, and after carefully studying Table 2-1, the operator will find it possible to master the controls with a minimum of practice. See Figure 4-1 for location of rear-panel facilities.

## 2-3. INITIAL ADJUSTMENTS

a. Gaining Access to Chassis

> **WARNING**
>
> Personal Contact with the ±250-volt Supplies May Prove FATAL

To gain access to the Type 343 or 345 chassis for making the initial adjustments, remove the rear protection cover. To completely remove the chassis from its cabinet, see Maintenance, paragraph 4-1.

b. Step-By-Step Alignment Procedure

The following procedure is required for the initial adjustment and/or whenever the driving oscillograph is changed. Refer to Section 4, Maintenance, for the complete alignment procedure in the event that the initial adjustment proves unsatisfactory. The initial alignment is as follows:

1. Connect the Type 2622 Cathode-follower Adapter to the driving oscillograph and to the Type 343 or 345 Cathode-ray Oscillograph (see Figure 2-1). Plug the power cords into the proper source and turn on the instrument. Allow one-half hour for the instruments to stabilize.

2. Driving oscillograph: With no signal input, adjust for a spot that is both vertically and horizontally centered.

> CAUTION
>
> Always keep the INTENSITY low on the Cathode-ray Oscillograph to avoid screen burning and discoloration.

3. Type 343/345 CRO: Set X and Y GAIN controls to center of range and connect voltmeters from J105 to ground and from J106 to ground.

4. Type 2622 CF Adapter: Adjust Y D-C LEVEL and Y BAL until voltages at J105 and J106 (Type 343/345) measure 3 volts. The difference in voltages between J105 and J106 should not exceed 0.1 volt.

5. Type 343/345 CRO: Disconnect voltmeters from J105 and J106; connect them from J204 to ground and from J205 to ground.

6. Type 2622 CF Adapter: Repeat step 4 except use X D-C LEVEL and X BAL controls.

7. Type 343/345 CRO: Disconnect voltmeters from J204 and J205; connect them from J103 to ground and from J104 to ground. Adjust R112 and R124 until voltages at J103 and J104 measure zero.

8. Type 343/345 CRO: Repeat step 7 except use J202 and J203; R212 and R224.

9. Driving oscillograph: Adjust sweep for full scale horizontal deflection.

10. Type 343/345 CRO: Set BEAM GATE SELECTOR to BEAM GATE. Adjust X GAIN for a corresponding full scale horizontal deflection.

11. Driving oscillograph: Apply a low frequency square wave (60-110 cps) to the vertical input and adjust the pattern for full scale vertical deflection.

12. Type 343/345 CRO: Adjust Y GAIN for a corresponding full scale vertical deflection.

13. Driving oscillograph: Apply a 5 kc square wave to the vertical input and adjust for several cycles on the screen.

14. Type 343/345 CRO: Connect a 50 uf capacitor from J105 (-) to ground (+).

15. Type 2622 CF Adapter: Adjust C104 for a correctly compensated square wave using the Type 343/345 CRO as the indicator.

16. Type 343/345 CRO: Remove the 50 uf capacitor from J105 and connect it from J106 to ground.

17. Type 2622 CF Adapter: Repeat step 15 except use C101.

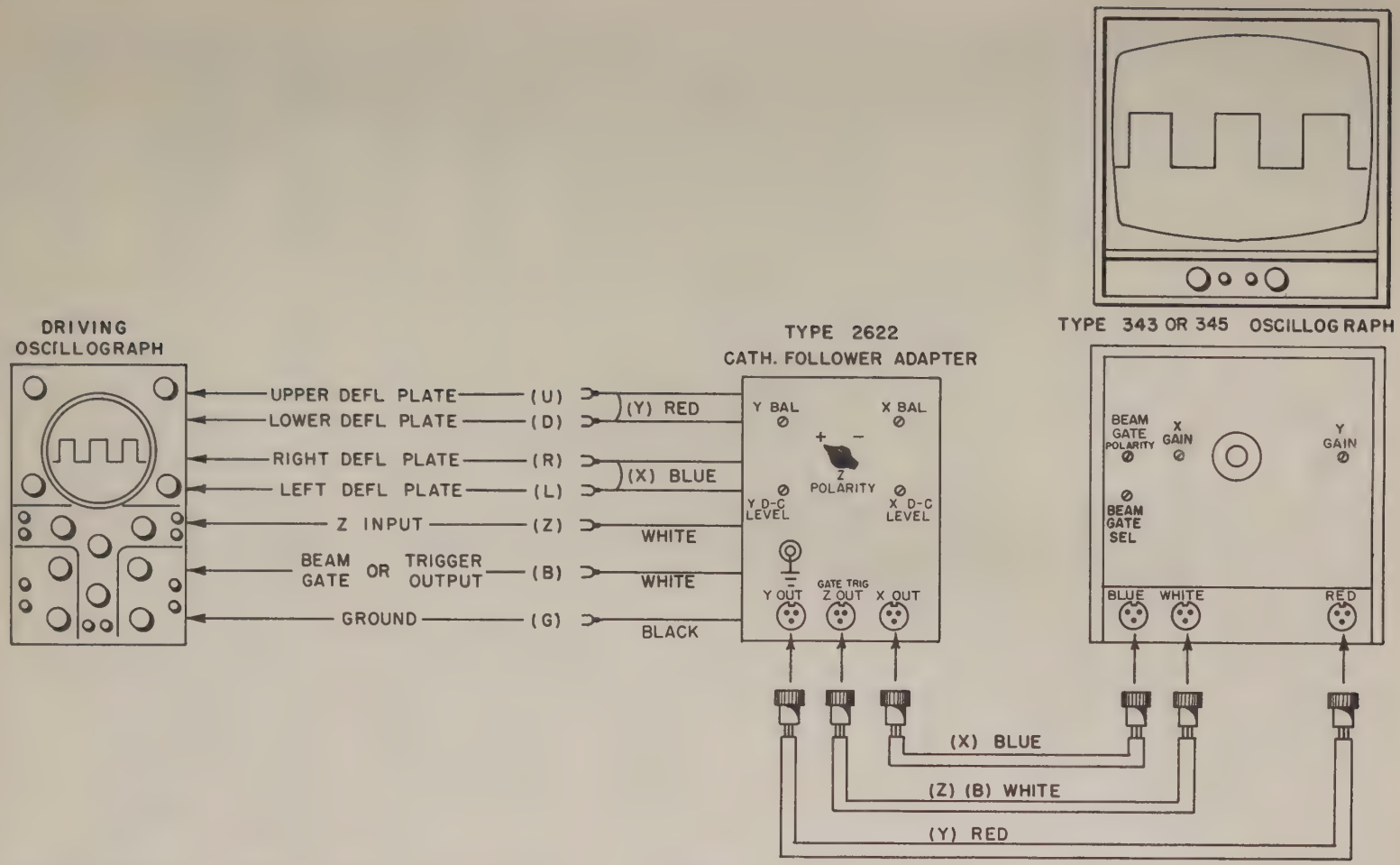
18. Type 343/345 CRO: Interchange the inputs to the Type 2622 CF Adapter. Remove the 50 uf capacitor from J106 and connect it from J204 to ground.

19. Type 2622 CF Adapter: Adjust C106 for a correctly compensated square wave using the Type 343/345 CRO as the indicator.

20. Type 343/345 CRO: Remove the 50 uf capacitor from J204 and connect it from J205 to ground.

21. Type 2622 CF Adapter: Repeat step 20 except use C109. Remove the 50 uf capacitor.

22. Restore the inputs to the Type 2622 CF Adapter to their original connections.




NOTE: WHEN "Z" OR "B" TERMINALS ARE NOT USED THEY SHOULD BE GROUNDED.

FIGURE 2-1. INTERCONNECTING DIAGRAM OF THE TYPE 343 OR 345, TYPE 2622 AND DRIVING OSCILLOGRAPH

TABLE 2-1

FRONT AND REAR-PANEL FACILITIES

| NAME | FUNCTION |
|---|---|
| | FRONT PANEL TYPE 343 OR 345 |
| INTENSITY | Control: Varies the trace brightness |
| FOCUS | Control: Adjusts the trace sharpness |
| POWER | Toggle Switch: Applies primary power to the instrument |
| | REAR PANEL TYPE 343 OR 345 |
| BEAM GATE POLARITY | Screwdriver Control: Switch permitting use of a trigger of either polarity |
| BEAM GATE SELECTOR | Screwdriver Control: Provides the following switching arrangements:<br>1. BEAM GATE position provides brightening of the trace during sweep forward time. It is used when the driving oscillograph has a beam gate available and to provide a similar gate in the remote indicator<br>2. NO GATE position is used when it is desired to use the horizontal amplifier for X, Y plotting and no return trace is desired<br>3. INTERNAL BLANK position provides internal retrace blanking, and is used when the driving oscillograph does not provide a beam gate |
| X GAIN | Screwdriver Control: Permits horizontal adjustment of observed pattern with respect to driving oscillograph |
| Y GAIN | Screwdriver Control: Permits vertical adjustment of observed pattern with respect to driving oscillograph |
| Y INPUT (RED) | Connector: AN type receptacle provides a means of connection between the input of the vertical amplifier of the Type 343 or 345 Cathode-ray Oscillograph to the vertical output of the Type 2622 Cathode-follower Adapter |

TABLE 2-1. FRONT AND REAR-PANEL FACILITIES (Continued)

| NAME | FUNCTION |
|---|---|
| | REAR PANEL TYPE 343 OR 345 (Continued) |
| X INPUT (BLUE) | Connector: AN type receptacle provides a means of connection between the input of the horizontal amplifier of the Type 343 or 345 Cathode-ray Oscillograph to the horizontal output of the Type 2622 Cathode-follower Adapter |
| Z INPUT (WHITE) | Connector: AN type receptacle provides a means of connection between the beam gate and Z-axis circuit of the Type 343 or 345 Cathode-ray Oscillograph to the Z Output of the Type 2622 Cathode-follower Adapter |
| | FRONT PANEL TYPE 2622 |
| Z POLARITY | Switch: Permits phase reversal of Z-axis signals |
| Y D-C LEVEL | Screwdriver Control: Permits adjustment of proper bias at input to V101 and V102 in the Type 343 or 345 Cathode-ray Oscillograph |
| Y BAL | Screwdriver Control: Used in conjunction with Y D-C LEVEL to permit the balancing of the bias voltages to V101 and V102 in the Type 343 or 345 Cathode-ray Oscillograph |
| X D-C LEVEL | Screwdriver Control: Permits adjustment of proper bias at input to V201 and V202 in the Type 343 or 345 Cathode-ray Oscillograph |
| X BAL | Screwdriver Control: Used in conjunction with X D-C LEVEL to permit the balancing of the bias voltages to V201 and V202 in the Type 343 or 345 Cathode-ray Oscillograph |
| Y OUTPUT (RED) | Connector: AN type receptacle provides a means of connection between the vertical output of the Type 2622 Cathode-follower Adapter and the vertical input of the Type 343 or 345 Cathode-ray Oscillograph |
| X OUTPUT (BLUE) | Connector: AN type receptacle provides a means of connection between the horizontal output of the Type 2622 Cathode-follower Adapter and the horizontal input of the Type 343 or 345 Cathode-ray Oscillograph |

TABLE 2-1. FRONT AND REAR-PANEL FACILITIES (Continued)

| NAME | FUNCTION |
|---|---|
| | FRONT PANEL TYPE 2622 (Continued) |
| Z OUTPUT (WHITE) | Connector: AN type receptacle provides a means of connection between the beam gate or trigger output of the Type 2622 Cathode-follower Adapter and the Type 343 or 345 Cathode-ray Oscillograph. Also connects output of Z-axis cathode follower to input of Z-axis amplifier of Type 343 or 345 Cathode-ray Oscillograph |
| POWER | Toggle Switch: Applies primary power to the instrument |
| (GROUND) ⏚ | Binding Post: Provides connection to chassis ground |
| | REAR PANEL TYPE 2622 |
| (U) & (D) (RED) | Spade Lugs: 300-ohm twin lead, provides connection to upper (U) and lower (D) deflection plate terminals |
| (R) & (L) (BLUE) | Spade Lugs: 300-ohm twin lead, provides connection to right (R) and left (L) deflection plate terminals |
| (Z) (WHITE) | Spade Lug: Z-input connection to driving oscillograph |
| (B) (WHITE) | Spade Lug: Beam gate or trigger output connection to driving oscillograph |
| (G) (BLACK) | Spade Lug: Ground connection to driving oscillograph |

# SECTION 3

# THEORY OF OPERATION

## 3-1. GENERAL

Since the vertical and horizontal amplifiers of the Types 343 and 345 Cathode-ray Oscillographs are identical except for symbol numbers, the circuit description will be limited to the vertical amplifier. The symbol numbers for the vertical amplifier are in the 100 series, and in the 200 series for the horizontal amplifier.

## 3-2. VERTICAL (OR HORIZONTAL) AMPLIFIER--Type 343 or 345

### a. Input Amplifier

V101 and V102 are connected as a direct coupled balanced amplifier. Signal input to this amplifier is applied from the driving oscillograph, through the Type 2622 Cathode-follower Adapter and the interconnecting cable, to connector J101 on the Type 343 or 345 Cathode-ray Oscillograph.

A balanced two-section potentiometer, Y GAIN (R130-A and R130-B), with a range of 7:2, sets the gain of the Type 343 or 345 with respect to the driving oscillograph. Proper input bias for V101 and V102 is established by the setting of the Y D-C LEVEL and Y BAL control, both located on the Type 2622 Cathode-follower Adapter.

### b. Balanced Cathode Follower

The signal at the plates of V101 and V102 is direct-coupled through parasitic suppressors (R103 and R123) to a balanced cathode follower (V103-A and V103-B). The series neon tube coupling network (E101-E106, E108-E115, and E117 & E118) couples the signal through a dc level of approximately 450 volts. This arrangement preserves signal amplitude down to dc with a small insertion loss. High-frequency compensation is accomplished by the trimmers (C108 and C109) connected in shunt with these neon tubes.

### c. Vertical Deflection Amplifier

To provide balanced deflection, two series amplifiers (V104-V105 and V106-V107) are operated back-to-back and the output of each drives separate yoke windings. The fields of the

yoke winding then combine to provide the net deflection field for the cathode-ray tube, hence the push-pull action. Proper bias for these series amplifiers are established by the BIAS controls (R112 and R124) which are adjusted until the voltages measured at J103 and J104 to ground read zero. Resistors (R113 and R125) in series with the BIAS controls prevent oscillations.

Assume for circuit analysis, a positive signal is applied to V105. Increasing current will flow through R107, increasing the bias on the grid of V104. The path of the increasing current is through the yoke and through the feedback resistor (R110) in the cathode of V101 to ground. When the signal goes in the opposite direction, the path of the current is reversed. Circuit analysis for V106 and V107 is the same as discussed above.

d. Y Deflection Coils

The Y deflection coils (L1 and L2) are direct-coupled to the vertical deflection amplifiers (V104-V107). Two separate windings are used. One end of each winding is connected to the electrical center of the vertical deflection amplifier. The other end is connected to the cathode-resistor (R110 or R118) of the input amplifier (V101 or V102). This arrangement provides negative feedback to improve the over-all response and linearity of the amplifier. A capacitor (C103) is shunted across the feedback loop ($V^1 - V^2$) to reduce negative feedback at the higher frequencies and therefore improve the rise-time. Damping is provided by shunt resistors (R108 and R121) to prevent ringing.

## 3-3. BEAM GATE

a. Brightening Gate

When the driving oscillograph is provided with a beam gate, a corresponding circuit in the Type 343 or 345 Cathode-ray Oscillograph can be initiated to provide a signal for brightening of the trace during forward sweep time. This is accomplished as follows: The beam gate from the driving oscillograph is coupled through C111 and R120 in the Type 2622 Cathode-follower Adapter. The initiating trigger is developed at the leading edge of the beam gate and the terminating trigger at its trailing edge. From the coupling network, the resulting triggers are applied to an amplifier (V103-A) and a cathode follower (V103-B). The level of the triggers are now suitable for driving the gate generator (V301-A and V301-B) in the Type 343 or 345 Cathode-ray Oscillograph through the BEAM GATE POLARITY switch.

If the initiating signal is negative, it is applied to the grid of V301-A; if it is positive, to the grid of V301-B. The resulting signal at the plate of V301-A is coupled to the grid of the cathode-ray tube (V401) when the BEAM GATE selector switch is set to BEAM GATE. The gate generator (V301) is restored to its original condition by the terminating trigger.

b. No Gate

When it is desired to use the Type 343 or 345 Cathode-ray Oscillograph for X, Y plotting, it is necessary to remove all blanking. The NO GATE position on the BEAM GATE selector switch connects the grid of the cathode-ray tube to the junction of a voltage divider (R421 and R422). The dc level of this junction enables the removal of all blanking, allowing the retrace to be visible.

c. Retrace Blanking

A circuit for internal retrace blanking is provided in the Type 343 or 345 Cathode-ray Oscillograph when the BEAM GATE selector switch is set to INTERNAL BLANK. This feature is used when the driving oscillograph does not provide a beam gate.

The internal blanking signal is derived from the X deflection coil (L4) during the sweep retrace interval. During this interval, a large negative pulse is developed across this coil and is capacitively coupled (C409) to the grid of the cathode-ray tube.

## 3-4. INTENSITY MODULATION

For intensity modulation, positive (blanking) or negative (brightening) signals are coupled from the driving oscillograph to the Z input terminal of the Type 2622 Cathode-follower Adapter. Use of this switch enables the intensity modulation signal coupled to the Type 343 or 345 Cathode-ray Oscillograph, to be in agreement with the driving oscillograph.

From the Z POLARITY switch, the signal is coupled to a cathode follower (V104-B), then through the interconnecting cable to the Type 343 or 345 Cathode-ray Oscillograph.

A Z GAIN potentiometer (R311) located in the grid circuit of the Z amplifier (V302-A) permits the intensity modulation level of the Type 343 or 345 Cathode-ray Oscillograph to be adjusted to the intensity modulation level of the driving oscillograph.

The output of the Z amplifier is coupled to a cathode follower (V302-A); the output of which is applied to the cathode-ray tube. Adjustment of the INTENSITY control varies the dc level of V302-B, thereby controlling the intensity of the cathode-ray tube.

## 3-5. POWER SUPPLY

a. Type 2622 Cathode-follower Adapter

A self-contained power supply furnishes all of the necessary operating potentials for this instrument. A conventional full-wave rectifier circuit is used. Regulated potentials of +150 volts and -150 volts, and an unregulated potential of +175 volts are provided.

b. Type 343 or 345 Cathode-ray Oscillograph

1. Low-voltage Section

The positive 250-volt output is derived from two 600-milliampere selenium rectifiers (CR501 and CR502) connected as a voltage doubler. The rectified output is filtered electronically by a series amplifier (V501). The full voltage output of the filter is regulated by the control amplifier (V503) and the voltage reference gas diode (V502).

The negative 250-volt supply functions in a similar manner except that the rectifiers used (CR503 and CR504) are rated at 500 milliamperes.

2. High-voltage Section

The accelerating potential required for the cathode-ray tube is derived from a regulated rf supply. This circuit consists of a rf oscillator (V403), a regulator control amplifier (V406), and a half-wave doubler (V402 and V405).

Regulation is accomplished by sampling a portion of the rectified output, and coupling a correction signal back through V406 to the screen grid of V403. For example, a decrease in rectified output would result in an error voltage fed back to the regulator control amplifier (V405), increasing its plate voltage. The correction signal is applied to the screen grid of the rf oscillator (V403). Hence the ac output voltage across T401 is increased, thus compensating for the decrease in output voltage mentioned earlier.

# SECTION 4

# MAINTENANCE

**WARNING**

**PERSONAL CONTACT WITH THE ±250-VOLT SUPPLIES MAY PROVE FATAL**

Observe the following precautions when necessary to energize the equipment with the cabinet removed.

1. Never work alone.
2. Make sure the chassis is properly grounded.
3. Disconnect power before removing any tubes.
4. Before touching any component, short terminal to remove any possible charge that may remain after removing the power.

## 4-1. GAINING ACCESS TO THE CHASSIS

To gain access to the chassis, remove the screws holding the rear protection cover and slip off cover. This will expose most of the tubes and service adjustments. To gain access to the remaining tubes and service adjustments, it will be necessary to completely remove the chassis from its cabinet. See paragraph 4-4 or 4-5.

## 4-2. SERVICE ADJUSTMENTS

Do not touch any service adjustments unless test clearly indicates the need to do so. Such adjustments should not be attempted without a complete understanding of the proper procedure. Consult Tables 4-1 and 4-2 for special instructions.

## 4-3. GENERAL TROUBLE SHOOTING

The first step in correcting any trouble or failure that may occur is to isolate the section of the circuit causing the trouble. Such isolation can be accomplished by considering the circuit as composed of the basic sections shown in the over-all block diagram, Figure 1-2. As an aid in servicing, Trouble Shooting Chart, Table 4-3 has been provided.

After isolating the trouble to a particular section, determine the specific tube circuit involved. A replacement should be tried before attempting any other test.

NOTE

Indiscriminate tube changing must be avoided. If after tube replacement the trouble persists, replace the original tube in its socket. Replacement of certain tubes will require resetting of one or more service adjustments. Consult Table 4-4 for special instructions.

If trouble persists, voltage and resistance measurements should be made. See Tables 4-5 through 4-8.

## 4-4. TYPE 343: REPLACEMENT OF CATHODE-RAY TUBE

CAUTION

The cathode-ray tube should be handled with great care to prevent breakage and/or serious personal injury from flying glass. Do not employ force at any time. As an added precaution, it is advisable to wear safety goggles and gloves.

The following step-by-step procedure is suggested for replacing the cathode-ray tube:

1. Turn off power; remove knobs and knurled ring from power switch on front panel.
2. Remove rear protection cover and disconnect fan.
3. Remove top and bottom covers.
4. Remove cathode-ray tube socket and mu-metal shield.
5. Disconnect deflection yoke socket and intensifier cap.
6. Loosen deflection yoke clamp; remove ion trap and yoke.
7. Remove molding, safety glass and mask from panel.
8. Remove single screw holding center mounting rod and lower four front-panel screws.
9. Remove the three screws from the top of both side panel supports.

10. Remove as one assembly, the front panel, the cathode-ray tube and supports.

11. Place assembly on a blanket or other suitable protective materials to prevent damage to the panel, glass, and tube.

12. Remove cathode-ray tube from front panel.

13. Remove wire basket from supporting strap.

14. Loosen supporting strap and remove.

15. To install new tube follow the above procedure in reverse.

16. Before replacing mu-metal shield, turn power on to check operation. Adjust ion trap and position deflection yoke.

CAUTION: HIGH VOLTAGE (6000 V)

## 4-5. TYPE 345: REPLACEMENT OF CATHODE-RAY TUBE

CAUTION

The cathode-ray tube should be handled with great care to prevent breakage and/or serious personal injury from flying glass. Do not employ force at any time. As an added precaution, it is advisable to wear goggles and gloves.

The following step-by-step procedure is suggested for replacing the cathode-ray tube:

1. Turn off power; remove knobs and knurled ring from power switch on front panel.

2. Remove rear protection cover.

3. Disconnect and remove fan.

4. Remove cathode-ray tube socket and mu-metal shield.

5. Disconnect deflection yoke socket and intensifier cap.

6. Loosen deflection yoke clamp; remove ion trap and yoke.

7. Remove the four screws on bottom of cabinet; slide chassis straight back and out.

NOTE: Use care when sliding chassis back over neck of tube.

8. Place cabinet face down on a blanket or other suitable protective materials to prevent damage to the glass and cabinet.

9. Remove the four nuts on the cathode-ray tube supporting bracket.

10. Remove the cathode-ray tube by grasping it on face side, lifting up and out, placing it face down on a soft cloth. (Do Not Lift Tube By Neck.)

11. Remove wire basket from front supporting strap.

12. Loosen front strap clamp and remove strap.

13. To install new tube follow the above procedure in reverse.

14. Before replacing back cover, turn power on to check operation. Adjust ion trap and position deflection yoke.

| CAUTION: HIGH VOLTAGE (6000 V) |
|---|

## 4-6. GAINING ACCESS TO THE RF HIGH-VOLTAGE SUPPLY

The following step-by-step procedure is suggested for gaining access to the rf high-voltage chassis:

1. Follow instructions for removal of the main chassis from its cabinet as given in paragraph 4-4 or 4-5. (See Figure 4-2.)

2. Remove screws that hold cover to case.

3. Remove cover, exposing supply.

## 4-7. CLEANING THE CRT AND SAFETY GLASS

The following step-by-step procedure is suggested for cleaning the cathode-ray tube and the safety glass:

a. Type 343 Cathode-ray Oscillograph

1. Turn power off; remove screws on top and bottom of frame.

2. Hold bottom of frame, letting top swing back, and lift frame, mask, and glass out.

3. Clean cathode-ray tube and safety glass.

4. Replace safety glass, mask, frame, and screws.

NOTE: Do not use solvents other than water to clean mask and scale.

b. Type 345 Cathode-ray Oscillograph

1. Turn power off; remove screws holding front top molding and remove molding.

2. Grasp top of safety glass, letting top swing back, and lift glass up and out. Mask will be removed with safety glass.

3. Clean cathode-ray tube and safety glass.

4. Replace safety glass, mask, molding, and screws.

NOTE: Do not use solvents other than water to clean mask and scale.

## 4-8. INTERCONNECTING CABLE ASSEMBLY

For assembly of the interconnecting cables refer to Figure 4-4.

## 4-9. LUBRICATION NOTICE

LUBRICATE FAN MOTOR MONTHLY

Saturate felt on both front and rear bearings with a high grade nongumming low-viscosity oil.

## 4-10. DU MONT OSCILLOGRAPHER

The Du Mont Oscillographer is a periodical published by the Allen B. Du Mont Laboratories, Inc. It is sent free of charge to engineers, research workers and those engaged in the use and application of cathode-ray equipment. When sending in subscriptions or notification of change of address, please supply the following information: name, position, company name and address, and type of business.

## 4-11. WARRANTY AND SERVICE NOTICE

All instruments produced by the Technical Products Division of the Allen B. Du Mont Laboratories, Inc., are sold under the Du Mont Warranty. For the provisions of this warranty and of the Technical Products Service Policies, see the Warranty and Service Notice on the inside back cover.

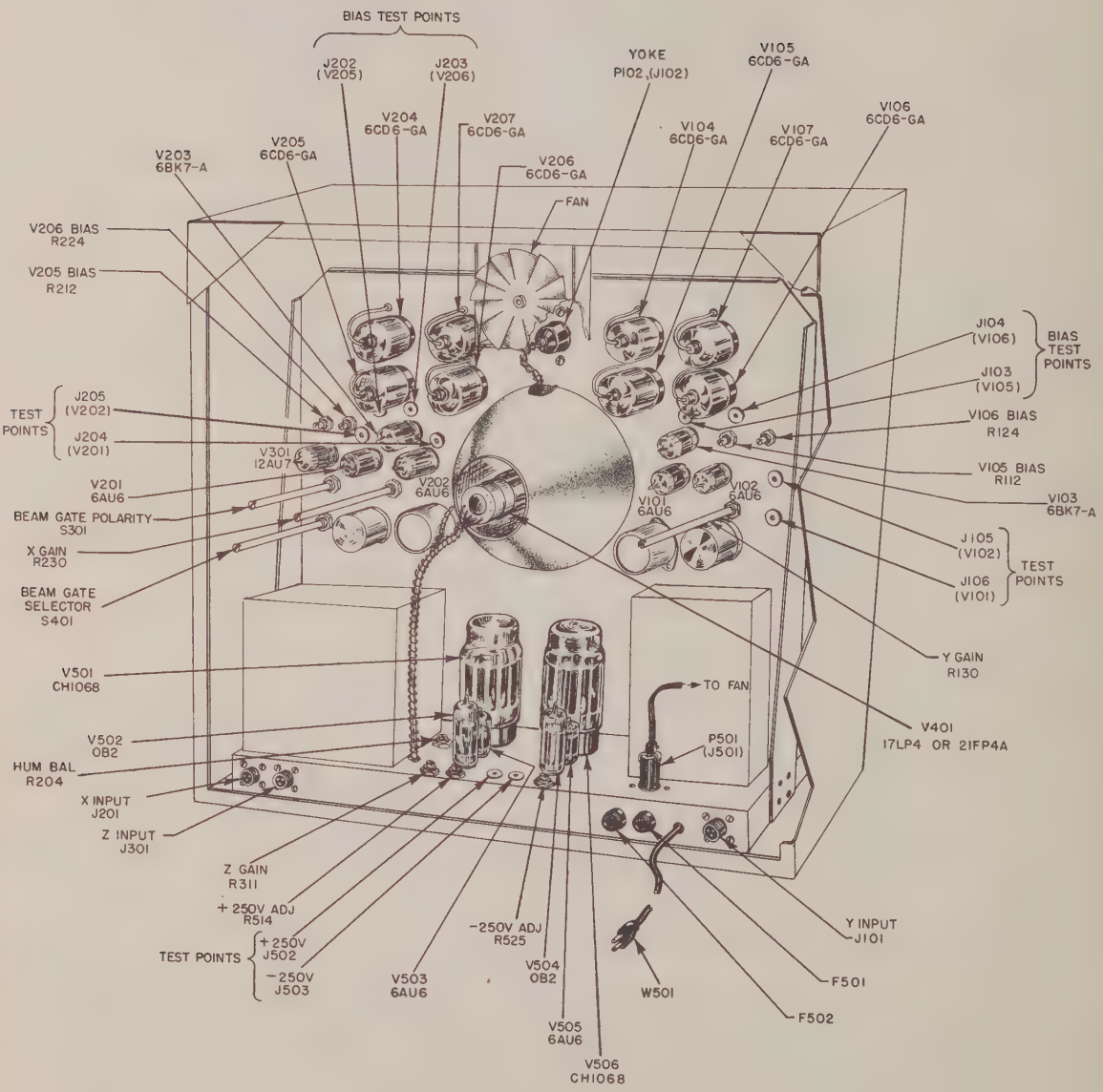



FIGURE 4-1. TUBE LOCATIONS AND SERVICE ADJUSTMENTS (REAR)

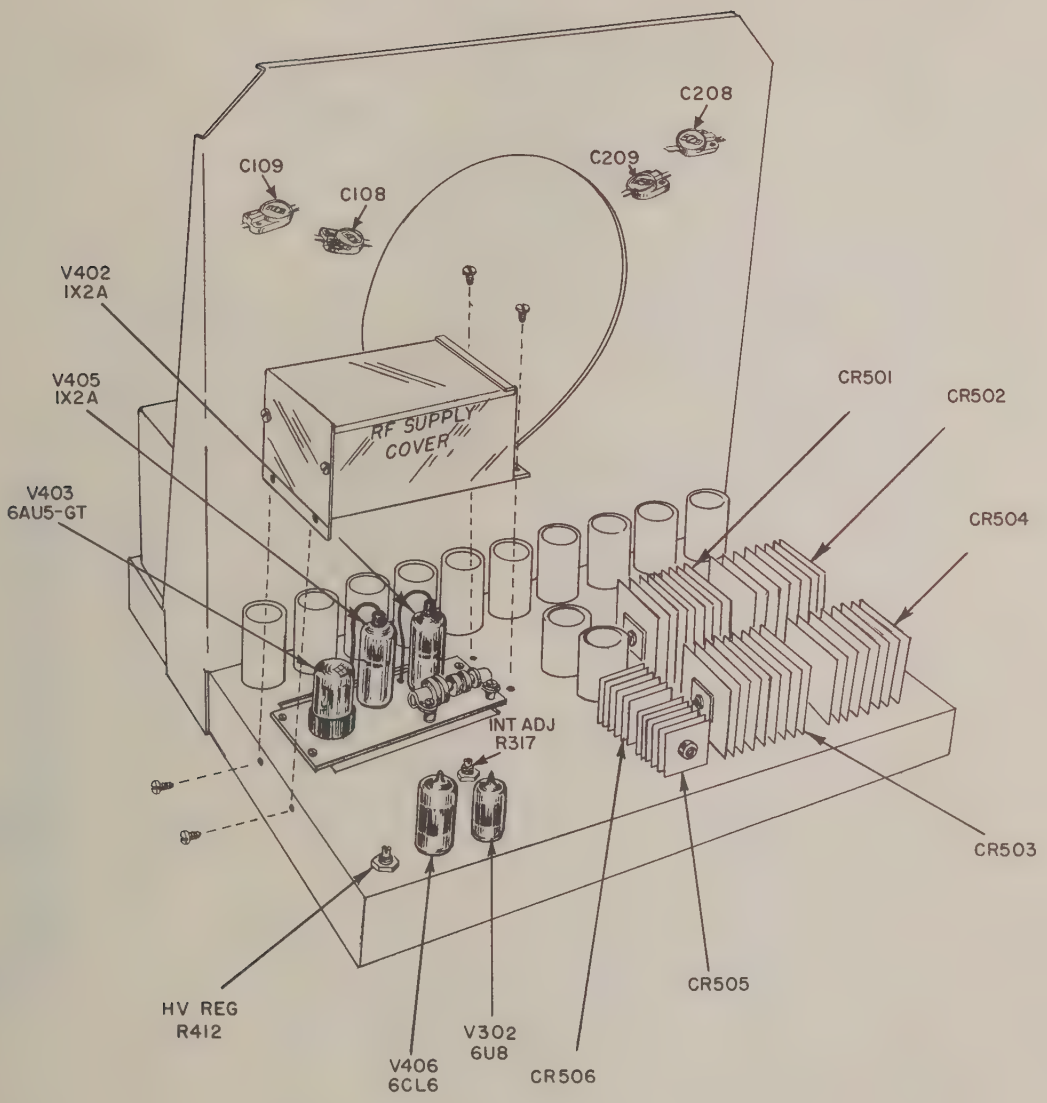



FIGURE 4-2. TUBE LOCATIONS AND SERVICE ADJUSTMENTS (FRONT)

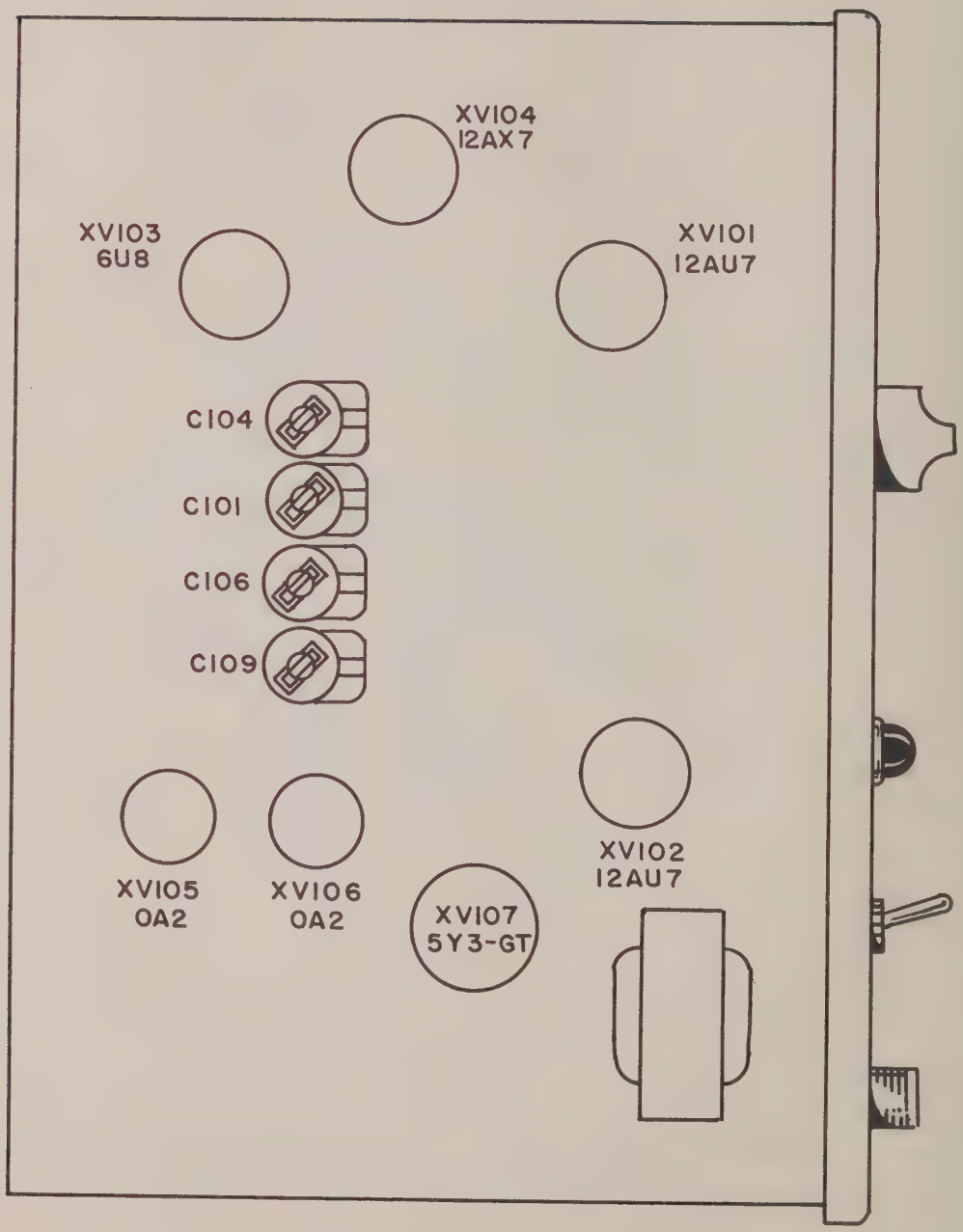
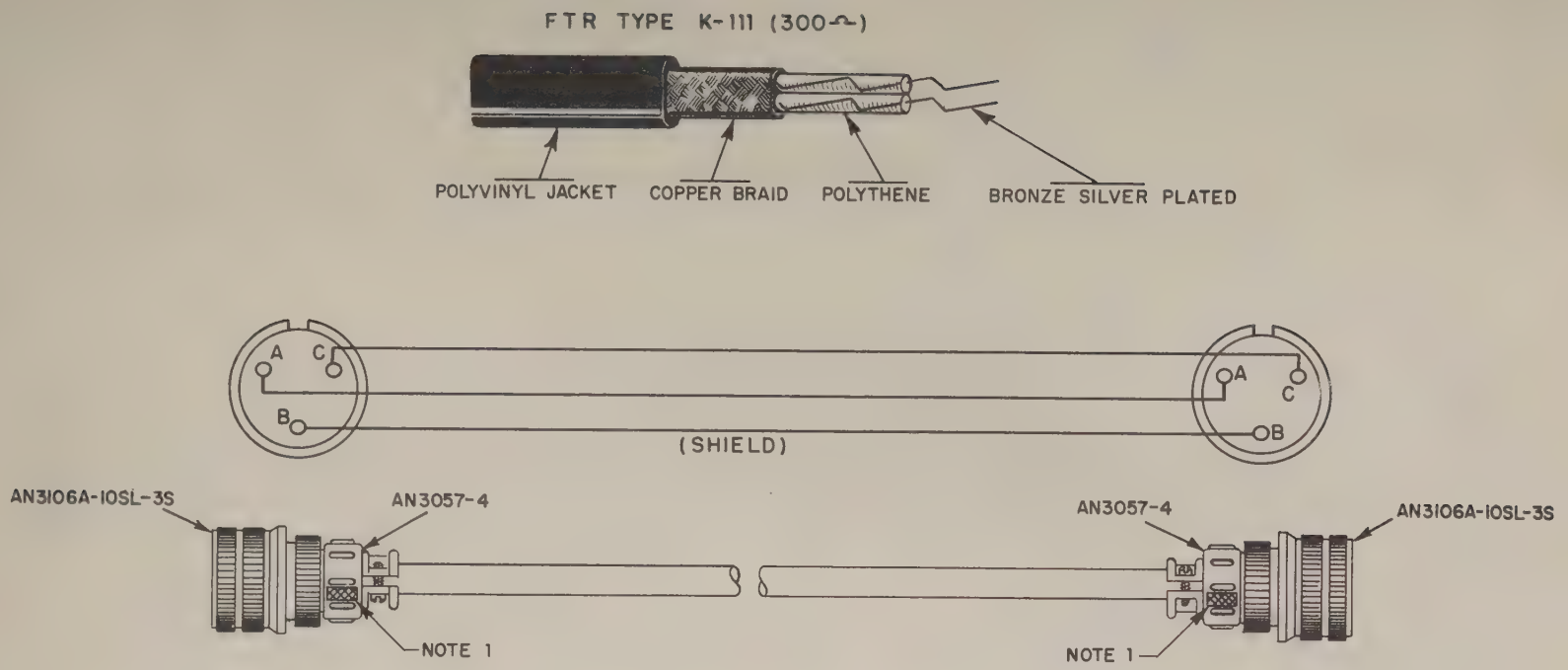



FIGURE 4-3. TYPE 2622 CATHODE-FOLLOWER ADAPTER, TUBE LOCATION AND SERVICE ADJUSTMENTS




NOTES:

1. A COLOR MARKER OF EITHER RED, WHITE, OR BLUE TAPE IS APPLIED TO EACH CONNECTOR FOR CABLE IDENTIFICATION AND TO FACILITATE HOOKUP.
2. TEN FOOT LENGTHS, FEMALE TO FEMALE, SUPPLIED WITH INSTRUMENT.
3. ADDITIONAL CABLES AVAILABLE IN 25, AND 75 FOOT LENGTHS (MALE TO FEMALE).

FIGURE 4-4. DIAGRAM OF INTERCONNECTING CABLES

TABLE 4-1

TEST EQUIPMENT REQUIRED FOR SERVICE ADJUSTMENTS

| REF. NO. | DESCRIPTION | RANGE OR CHARACTERISTICS |
|---|---|---|
| (1) | Volt-ohmmeter | 20K ohms/volt test meter |
| (2) | Driving oscillograph | Any low-frequency oscillograph |
| (3) | Cathode-ray oscillograph | General purpose oscillograph |
| (4) | Square-wave generator | 100 cps to 5 kc |
| (5) | High-voltage meter | Cable of reading 6000 volts |

TABLE 4-2

SERVICE ADJUSTMENT CHART

NOTE

DO NOT SET ANY SERVICE ADJUSTMENT WITHOUT FOLLOWING SPECIFIC INSTRUCTIONS AND SEQUENCE GIVEN BELOW. SOME ADJUSTMENTS ARE INDEPENDENT. ALLOW 1/2 HOUR WARM-UP TIME.

| NAME & LOCATION | TE* | ADJUSTMENT PROCEDURE |
|---|---|---|
| REG ADJ (R514) Fig. 4-1 | (1) | Connect a voltmeter from the +250 V test point (J502) and ground. Adjust R514 to 250 volts, ±1 volt |
| REG ADJ (R525) Fig. 4-1 | (1) | Connect a voltmeter from the -250 V test point (J503) and ground. Adjust R525 to -250 volts, ±1 volt |
| HUM BAL (R204) Fig. 4-1 | (3) | Connect a cathode-ray oscillograph between J502 and ground. Adjust R204 for minimum ripple. Recheck R514 and R525 |
| HV REG (R412) Fig. 4-2 | (5) | Set INTENSITY and INT ADJ (Fig. 4-2) fully counter-clockwise. Connect a high-voltage meter from the top side of R410 to ground. Adjust R412 to 6000 volts, ±100 volts |
| INT ADJ (R317) Fig. 4-2 | - | Set BEAM GATE SELECTOR (Fig. 4-1) to NO GATE and INTENSITY to middle of range. Adjust R317 until trace just appears |
| Y D-C LEVEL & Y BAL (Type 2622 CF Adapter) | (1) & (2) | 1. Connect the Type 2622 Cathode-follower Adapter to the driving oscillograph and to the Type 343 or 345 CRO<br>2. Type 343/345 CRO: Set X GAIN and Y GAIN controls to center of range. Connect voltmeters from J105 to ground and from J106 to ground<br>3. Type 2622-CF Adapter: Adjust Y D-C LEVEL and Y BAL until voltages at J105 and J106 measure three volts. The difference in voltages between J105 and J106 should not exceed 0.1 volt |

*Number shown ( ) corresponds to reference number of test equipment in Table 4-1

TABLE 4-2. SERVICE ADJUSTMENT CHART (Continued)

| NAME & LOCATION | TE* | ADJUSTMENT PROCEDURE |
|---|---|---|
| X D-C LEVEL & X BAL (Type 2622 CF Adapter) | (1) & (2) | Same as Y D-C LEVEL and Y BAL except voltmeters are connected from J204 and J205 to ground and the corresponding X controls are used |
| (Y) BIAS (R112 & R124) Fig. 4-1 | (1) | Connect voltmeters from J103 to ground and from J104 to ground. Adjust R112 and R124 until voltages at J103 and J104 measure zero |
| (X) BIAS (R212 & R224) Fig. 4-1 | (1) | Connect voltmeters from J202 to ground and from J203 to ground. Adjust R212 and R224 until voltages at J203 and J204 measure zero |
| Y GAIN (R130) Fig. 4-1 | (2) & (4) | 1. Driving oscillograph: Apply a 100-cycle square wave to the vertical input and adjust the resulting pattern for full screen width and height<br>2. Type 343/345 CRO: Adjust Y GAIN for a corresponding full screen vertical deflection |
| X GAIN (R230) Fig. 4-1 | (2) & (4) | Same as Y GAIN except adjust X GAIN so pattern is full screen horizontally |
| Type 2622 CF Adapter: Y (C104 & C101) and X (C106 & C109) Compensation Fig. 4-3 | (4) | 1. Driving oscillograph: Apply a 5-kc square wave to the vertical input and adjust for several cycles on the screen<br>2. Type 343/345 CRO: Temporarily connect a 50-uf capacitor from J105 to ground<br>3. Adjust C104 for a correctly compensated square wave using the Type 343 or 345 as the indicator<br>4. Repeat steps 2 and 3 except use J106 and C101<br>5. Type 2622 CF Adapter: Interchange the X and Y cables to driving oscillograph<br>6. Repeat steps 2 and 3 except use J204 and C106<br>7. Repeat steps 2 and 3 except use J205 and C109<br>8. Restore the X and Y cables to their original connections |

*Number shown ( ) corresponds to reference number of test equipment in Table 4-1

TABLE 4-2. SERVICE ADJUSTMENT CHART (Continued)

| NAME & LOCATION | TE* | ADJUSTMENT PROCEDURE |
|---|---|---|
| Z GAIN (R311)<br>Fig. 4-1 | - | Adjust R311 so that the intensity modulation level on the Type 343 is equal to the intensity level of the driving oscillograph |
| X (C108 & C109) and Y (C208 & C209) High-frequency Compensation | (4) | 1. Driving oscillograph: Apply a 5-kc square wave to the vertical input and adjust for several cycles on the screen<br>2. Type 343/345 CRO: Adjust C108 and C109 for optimum square wave response<br>3. Type 343/345 CRO: Interchange the X (Blue) and Y (Red) cables<br>4. Repeat step 2 except use C208 and C209<br>5. Restore the X and Y cables to their original connections |

*Number shown ( ) corresponds to reference number of test equipment in Table 4-1

TABLE 4-3

TROUBLE SHOOTING CHART

| SYMPTOM | PROBABLE CAUSE | REMEDY |
|---|---|---|
| | POWER SUPPLY AND CRT CIRCUITRY | |
| 1-1. Pilot indicator fails to light | 1-1a. Line cord not plugged into a live outlet | 1-1a. Trace line failure |
| | 1-1b. Pilot indicator lamp open | 1-1b. Replace I501 |
| | 1-1c. Blown fuse | 1-1c. Replace F502 |
| | 1-1d. Defective POWER switch (S501) | 1-1d. Replace |
| 1-2. Line fuse blows when POWER switch is turned ON | 1-2a. Defective Power Supply | 1-2a. Make resistance checks as follows:<br>Supply — Resistance to Chassis<br>6000V — 83M<br>250V — 75K<br>-250V — 74K<br>-450V — 160K |
| | 1-2b. Defective line cord | 1-2b. (1) Resistance between prongs of line cord<br>POWER switch off: infinity<br>POWER switch on: 2.5 ohms<br>(2) Resistance of either prong of the line cord to ground: infinity |
| 1-3. No spot of CRT screen when driving oscillograph and Type 2622 are operative | 1-3a. Depositioned ion-trap | 1-3a. Adjust ion-trap for maximum brightness and optimum focus |
| | 1-3b. CRT not properly seated in socket | 1-3b. Properly seat CRT in socket |
| | 1-3c. Defective CRT | 1-3c. Check that CRT is lit or feel for warmth<br>CAUTION: HIGH VOLTAGE |
| | 1-3d. Defective rf high-voltage supply | 1-3d. (1) Check output of high voltage; should measure 6000 volts. See Service Adjustment Chart, Table 4-2<br>(2) Check voltage and resistance of the regulator control amplifier (V406), the rf oscillator (V403), and the half-wave doubler (V402 and V403) |
| | 1-3e. Defective low-voltage supply (+250V, -250V and +400V) | 1-3e. (1) These low voltages are required for application to the plate and screen of the rf oscillator (V403) and the oscillator voltage regulator (V406) |
| | | (2) Incorrect voltage output of these supplies is nearly always caused by bad series current regulator or regulator control amplifier tubes. In the paragraphs which follow change the tube first before checking the voltage and resistance |
| | | (3) Check value of +250-volt supply at J502; if incorrect see Service Adjustment Chart, Table 4-2<br>(4) +250-volt circuitry: Check tube pin voltage and resistance of the series current regulator (V501), regulator control amplifier (V503), and the voltage reference (V502)<br>(5) Check value of -250-volt supply at J503; if incorrect see Service Adjustment Chart, Table 4-2<br>(6) -250-volt circuitry: Check tube pin voltage and resistance on the series current regulator (V506), regulator control amplifier (V505), and the voltage reference (V504) |

TABLE 4-3. TROUBLE SHOOTING CHART (Continued)

| SYMPTOM | PROBABLE CAUSE | REMEDY |
|---|---|---|
| | POWER SUPPLY AND CRT CIRCUITRY | |
| 1-4. No spot on CRT screen with driving oscillograph operating | 1-4a. Loose or broken connections between the driving oscillograph and the Type 2622 Cathode-Follower Adapter | 1-4a. Check connections to rear of driving oscillograph. See Figure 2-1. |
| | 1-4b. Loose or defective interconnecting cable between the Type 2622 Cathode-follower Adapter and the Type 343/345 CRO | 1-4b. Tighten, repair, or replace. See Figure 4-4 |
| | 1-4c. Defective Type 2622 (Pilot Light off) | 1-4c. (1) Check for blown fuse (F101)<br>(2) Check rectifier (V107) and gas diodes (V105 and V106)<br>(3) Measure voltage and resistance per V & R Tables |
| | 1-4d. Defective Type 2622 (Pilot Light on) | 1-4d. To check: Connect voltmeter between terminal A of Y OUT plug on the Type 2622 and ground. Position trace upward on driving oscillograph. Voltage measured at terminal A should swing positive. Repeat test at terminal A of X OUT plug<br>(1) If no positive swing on Y axis, check V101<br>(2) If no positive swing on X axis, check V102<br>(3) Measure voltage and resistance per V & R Tables |
| 1-5. Hum on trace | 1-5. HUM BAL (R204) improperly set | 1-5. See Service Adjustment Chart, Table 4-2 |
| | VERTICAL AMPLIFIER | |
| 2-1. Sweep OK; no vertical deflection | 2-1a. Defective Y-axis circuit in Type 2622 Cathode-follower Adapter | 2-1a. See 1-4d |
| | 2-1b. Loose or defective Y (Red) interconnecting cable | 2-1b. Tighten, repair, or replace. See Figure 4-4 |
| | 2-1c. Trace may be depositioned off screen due to a defective vertical amplifier stage | 2-1c. Check as indicated below:<br>(1) Connect a voltmeter between J103 on Type 343 or 345 CRO and ground. Position trace upward on driving oscillograph. Voltage measured at J103 should swing positive<br>(a) If no positive swing, check V101, V103A, V104, and V105<br>(b) Check to see if all neons light<br>(2) Connect a voltmeter between J104 and ground. Position trace downward on driving oscillograph. Voltage measured at J104 should swing negative<br>(a) If no negative swing, check V102, V103B, V106, and V107.<br>(b) Check to see if all neons light |
| 2-2. Sweep OK; unequal vertical expansion as Y GAIN is advanced | 2-2. Y BAL & Y D-C LEVEL on Type 2622 Cathode-follower Adapter improperly set | 2-2. See Service Adjustment Chart, Table 4-2 |

TABLE 4-3. TROUBLE SHOOTING CHART (Continued)

| SYMPTOM | PROBABLE CAUSE | REMEDY |
|---|---|---|
| | VERTICAL AMPLIFIER | |
| 2-3. Pattern on driving oscillograph is vertically centered; not vertically centered on Type 343 or 345 CRO | 2-3. (Y) BIAS service adjustments (R112 & R124) improperly set | 2-3. See Service Adjustment Chart, Table 4-2 |
| 2-4. Full height pattern on driving oscillograph; less than full height on Type 343 or 345 CRO | 2-4. Y GAIN (R130) improperly set | 2-4. See Service Adjustment Chart, Table 4-2 |
| | HORIZONTAL AMPLIFIER | |
| 3-1. Vertical deflection OK; no horizontal deflection | 3-1a. Defective X-axis circuit in Type 2622 Cathode-follower Adapter | 2-1a. See 1-4d |
| | 3-1b. Loose or defective X (Blue) interconnecting cable | 3-1b. Tighten, repair, or replace. See Figure 4-4 |
| | 3-1c. Trace may be depositioned off screen due to a defective horizontal amplifier stage | 3-1c. Check as indicated below:<br>(1) Connect a voltmeter between J202 on Type 343 or 345 CRO and ground. Position trace to the right on the driving oscillograph. Voltage measured at J202 should swing positive<br>(a) If no positive swing, check V201, V203A, V204 and V205<br>(b) Check to see if all neons light<br>(2) Connect a voltmeter between J203 and ground. Position trace to the left on the driving oscillograph. Voltage measured at J203 should swing negative.<br>(a) If no negative swing, check V202, V203B, V206, and V207<br>(b) Check to see if all neons light |
| 3-2. Vertical deflection OK; unequal horizontal expansion as X GAIN is advanced | 3-2. X BAL & X D-C LEVEL on Type 2622 Cathode-Follower Adapter improperly set | 3-2. See Service Adjustment Chart, Table 4-2 |
| 3-3. Pattern on driving oscillograph is horizontally centered; not horizontally centered on Type 343 or 345 CRO | 3-3. (X) BIAS service adjustments (R212 & R224) improperly set | 3-3. See Service Adjustment Chart, Table 4-2 |
| 3-4. Full width pattern on driving oscillograph; less than full width on Type 343 or 345 CRO | 3-4. X GAIN (R230) improperly set | 3-4. See Service Adjustment Chart, Table 4-2 |

TABLE 4-3. TROUBLE SHOOTING CHART (Continued)

| SYMPTOM | PROBABLE CAUSE | REMEDY |
|---|---|---|
| | BEAM GATE AND Z-AXIS CIRCUITRY | |
| 4-1. No forward trace brightening on Type 343 or 345 CRO when BEAM GATE SELECTOR is set to BEAM GATE | 4-1a. Loose or broken connections between the driving oscillograph and the Type 2622 Cathode-follower Adapter and/or the Type 343/345 CRO | 4-1a. Check connections to rear of driving oscillograph. See Figure 2-1 |
| | 4-1b. Defective beam gate circuit in Type 2622 Cathode-follower Adapter | 4-1b. (1) Check V103: measure voltage and resistance per V & R Tables<br>(2) Check signal continuity thru differentiating network (C111 & R120), thru the trigger amplifier (V103A), thru the trigger cathode follower (V103B) to pin A of J103 |
| | 4-1c. Defective beam gate circuit in Type 343 or 345 CRO | 4-1c. Check beam gate generator (V301); measure voltage and resistance per V & R Tables |
| | 4-1d. Defective BEAM GATE POLARITY (S301) and/or SELECTOR (S401) switches | 4-d. Check continuity of switches |
| 4-2. Trace not visible when BEAM GATE SELECTOR is set to BEAM GATE | 4-2a. INT ADJ (R317) improperly set | 4-2a. See Service Adjustment Chart, Table 4-2 |
| | 4-2b. Defective Z-axis circuit (Type 343/345) | 4-2b. Check V302; measure voltage and resistance per V & R Tables |
| 4-3. Return trace visible when BEAM GATE SELECTOR is set to INT BLANK | 4-3. Open coupling capacitor (C409) | 4-3. Check and replace |
| 4-4. No intensity modulation signal | 4-4a. Loose or broken connections between the Type 2622 Cathode-follower Adapter and/or the Type 343/345 CRO | 4-4a. Check connections and continuity per Figure 2-1 |
| | 4-4b. Defective Z-axis circuit in Type 2622 Cathode-follower Adapter | 4-4b. Check V104: measure voltage and resistance per V & R Tables. Check signal continuity thru the Z phase splitter (V104A), the Z POLARITY switch (S102), thru the Z cathode follower (V104B) to pin C of J103 |
| | 4-4c. Defective Z-axis circuit in Type 343/345 CRO | 4-4c. Check Z amplifier (V302A) and Z cathode follower (V302B); measure voltage and resistance |

TABLE 4-4

ADJUSTMENTS TO BE MADE WHEN REPLACING TUBES

| TUBE | | SERVICE ADJUSTMENT |
|---|---|---|
| REF SYMBOL | TYPE | |
| V101 | 6AU6 | Y GAIN (R130) |
| V102 | 6AU6 | Same as V101 |
| V105 | 6CD6-GA | V105 BIAS (R112), Y GAIN (R130) |
| V106 | 6CD6-GA | V106 BIAS (R124), Y GAIN (R130) |
| V201 | 6AU6 | X GAIN (R230) |
| V202 | 6AU6 | Same as V201 |
| V205 | 6CD6-GA | V205 BIAS (R212), X GAIN (R230) |
| V206 | 6CD6-GA | V206 BIAS (R224), X GAIN (R230) |
| V302 | 6U8 | Z GAIN (R311), INT ADJ (R317) |
| V402 | 1X2-A | HV REG (R412) |
| V403 | 6AU5-GT | Same as V402 |
| V405 | 1X2-A | Same as V402 |
| V406 | 6CL6 | Same as V402 |
| V501 | CH1068 | +250 REG ADJ (R514) |
| V502 | OB2 | Same as V501 |
| V503 | 6AU6 | Same as V501 |
| V504 | OB2 | -250 REG ADJ (R525) |
| V505 | 6AU6 | Same as V504 |
| V506 | CH1068 | Same as V504 |

TABLE 4-5. VOLTAGE MEASUREMENTS

TYPE 343 OR 345 CATHODE-RAY OSCILLOGRAPH

NOTES: 1. All voltages measured with a 20K-ohm/volt meter; measurements were taken from tube socket to chassis, except where otherwise indicated

2. All voltages are dc and positive with respect to chassis, except where otherwise indicated

3. *Indicates dummy tube socket terminal used as a tie point

| Symbol | Type | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | CAP |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | VERTICAL AMPLIFIER | | | | | | |
| V101 | 6AU6 | -3.3 | 0 | 6.3ac | | 160 | 135 | 0 | ... | ... | ... |
| V102 | 6AU6 | -3.3 | 0 | 6.3ac | | 165 | 135 | 0 | ... | ... | ... |
| V103 | 6BK7-A | 250 | 188 | 188 | 6.3ac | | 250 | 173 | 173 | ... | ... |
| V104 | 6CD6-GA | ... | 0 | ... | | -41 | ... | 6.3ac | 200 | ... | 200 |
| V105 | 6CD6-GA | -62* | -250 | ... | | -285 | 286* | 6.3ac | -63 | ... | -40 |
| V106 | 6CD6-GA | -62* | -250 | ... | | -286 | 286* | 6.3ac | -63 | ... | -41 |
| V107 | 6CD6-GA | ... | 0 | ... | | -40 | ... | 6.3ac | 200 | ... | 200 |
| | | | | | HORIZONTAL AMPLIFIER | | | | | | |
| V201 | 6AU6 | -3 | 0 | 6.3ac | | 181 | 142 | 0 | ... | ... | ... |
| V202 | 6AU6 | -3 | 0 | 6.3ac | | 181 | 142 | 0 | ... | ... | ... |
| V203 | 6BK7-A | 250 | 180 | 180 | 6.3ac | | 250 | 192 | 185 | ... | ... |
| V204 | 6CD6-GA | ... | 0 | 0 | | -44 | ... | 6.3ac | 200 | ... | 200 |
| V205 | 6CD6-GA | -67* | -250 | ... | | -284 | 282* | 6.3ac | -70 | ... | -42 |
| V206 | 6CD6-GA | -67* | -250 | ... | | -270 | -272* | 6.3ac | -70 | ... | -42 |
| V207 | 6CD6-GA | ... | 0 | ... | | -42 | ... | 6.3ac | 200 | ... | 200 |

TABLE 4-5. VOLTAGE MEASUREMENTS (Continued)

TYPE 343 OR 345 CATHODE-RAY OSCILLOGRAPH

| Symbol | Type | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | CAP |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | BEAM GATE AND Z AXIS | | | | | | |
| V301 | 12AU7 | 237 | 98 | 128 | | | 157 | 128 | 128 | | ... |
| | | | | | | 6.3ac | | | | | |
| V302 | 6U8 | 247 | 0 | 101 | 6.3ac | | 140 | 1 | 150 | 150 | ... |
| | | | | | CATHODE-RAY TUBE | | | | | | |
| V401 | 17LP4 or 21FP4A | Refer to over-all Schematic for pertinent pin voltages | | | | | | | | | |
| | | | | | RF HIGH-VOLTAGE SUPPLY | | | | | | |
| V402 | 1X2-A | 6KV | 6KV | ... | 6KV | 6KV | 6KV | ... | 6KV | 6KV | 3KV 3000 RF |
| | | | 1.25 RF | | | | | | | | |
| V403 | 6AU5-GT | -160 | | 0 | ... | 400 | ... | | 60 | ... | ... |
| | | | | | 6.3ac | | | | | | |
| V405 | 1X2-A | 3KV | 3KV | ... | 3KV | 3KV | 3KV | ... | 3KV | 3KV | 0 |
| | | 1.25 RF | | | | | | | | | |
| V406 | 6CL6 | 0 | 0 | 162 | 6.3ac | | 82 | 0 | 162 | -4.6 | ... |
| | | | | | LOW-VOLTAGE SUPPLY | | | | | | |
| V501 | CH1068 | | 250 | 250 | 250 | 200 | 400 | | ... | ... | ... |
| | | | | | 6.3ac | | | | | | |
| V502 | 0B2 | 107 | 0 | ... | 0 | 170 | ... | 0 | ... | ... | ... |
| V503 | 6AU6 | 100 | 107 | 6.3ac | | 210 | 270 | 107 | ... | ... | ... |
| V504 | 0B2 | -146 | -250 | ... | -250 | -147 | ... | -250 | ... | ... | ... |
| V505 | 6AU6 | -190 | -190 | 6.3ac | | -36 | -1.8 | -190 | ... | ... | ... |

TABLE 4-6. RESISTANCE MEASUREMENTS

TYPE 343 OR 345 CATHODE-RAY OSCILLOGRAPH

NOTES: 1. All resistance measurements taken from tube socket to chassis

2. K = 1000 ohms; M = megohm

3. *Indicates dummy socket terminal used as a tie point

| Symbol | Type | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | CAP |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | VERTICAL AMPLIFIER | | | | | | |
| V101 | 6AU6 | 1M | 30 | 00 | 00 | 110K | 160K | 30 | ... | ... | ... |
| V102 | 6AU6 | 1M | 30 | 00 | 00 | 110K | 160K | 30 | ... | ... | ... |
| V103 | 6BK7-A | 61K | 103K | 30K | 00 | 00 | 61K | 103K | 30K | ... | ... |
| V104 | 6CD6-GA | ... | 00 | 44 | ... | 1.8K | ... | 00 | 65K | ... | 66K |
| V105 | 6CD6-GA | 7K* | 80 | 80K | ... | 470K | 493* | 80K | 7K | ... | 683 |
| V106 | 6CD6-GA | 7K* | 00 | 78 | ... | 510K | ... | 00 | 7K | ... | 677 |
| V107 | 6CD6-GA | ... | 00 | 45 | ... | 1.8K | ... | 00 | 65K | ... | 65K |
| | | | | | HORIZONTAL AMPLIFIER | | | | | | |
| V201 | 6AU6 | 1M | 27 | 00 | 00 | 108K | 162K | 27 | ... | ... | ... |
| V202 | 6AU6 | 1M | 28 | 00 | 00 | 106K | 162K | 28 | ... | ... | ... |
| V203 | 6BK7-A | 61K | 103K | 31K | 00 | 00 | 61K | 104K | 29K | ... | ... |
| V204 | 6CD6-GA | ... | 00 | 44 | ... | 1.8K | ... | 00 | 66K | ... | 66K |
| V205 | 6CD6-GA | 7K* | ... | 77K | ... | 503K | 547K* | 00 | 7K | ... | 675 |
| V206 | 6CD6-GA | 7K* | 78K | 95K | ... | 480K | 493K* | 77K | 7K | ... | 668 |
| V207 | 6CD6-GA | ... | 00 | 50 | ... | 1.8K | ... | 00 | 66K | ... | 66K |

TABLE 4-6. RESISTANCE MEASUREMENTS (Continued)

TYPE 343 OR 345 CATHODE-RAY OSCILLOGRAPH

| Symbol | Type | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | CAP |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | BEAM GATE AND Z AXIS | | | | | | |
| V301 | 12AU7 | 67K | 200K | 30K | 00 | 00 | 71K | 217K | 30K | 00 | ... |
| V302 | 6U8 | 65K | 167K | 120K | 00 | 00 | 80K | 102 | 10K | 93K | ... |
| | | | | | CATHODE-RAY TUBE | | | | | | |
| V401 | 17LP4 or 21FP4A | Refer to over-all Schematic for pertinent resistances | | | | | | | | | |
| | | | | | RF HIGH-VOLTAGE SUPPLY | | | | | | |
| V402 | 1X2-A | 83M | 83M | ... | 83M | 83M | 83M | ... | 83M | 83M | 00 |
| V403 | 6AU5-GT | 183K | 00 | 0 | ... | 103K | ... | 00 | 83 | ... | ... |
| V405 | 1X2-A | 00 | 00 | ... | 00 | 00 | 00 | ... | 00 | 00 | 0 |
| V406 | 6CL6 | 0 | 2.3M | 86K | 00 | 00 | 81K | 0 | 87K | 2.3M | ... |
| | | | | | LOW-VOLTAGE SUPPLY | | | | | | |
| V501 | CH1068 | 00 | 74K | 74K | 74K | 317K | 87K | 00 | ... | ... | ... |
| V502 | OB2 | 85K | 0 | ... | 0 | 85K | ... | 0 | ... | ... | ... |
| V503 | 6AU6 | 98K | 85K | 00 | 00 | 290K | 1.7M | 85K | ... | ... | ... |
| V504 | OB2 | 167K | 74K | ... | 74K | 167K | ... | 74K | ... | ... | ... |
| V505 | 6AU6 | 118K | 167K | 00 | 00 | 228K | 1.5M | 167K | ... | ... | ... |

TABLE 4-7. VOLTAGE MEASUREMENTS

TYPE 2622 CATHODE-FOLLOWER ADAPTER

NOTES: 1. All voltages measured with a 20K-ohm/volt meter; measurements were taken from tube socket to chassis, except where otherwise indicated

2. All voltages are dc and positive with respect to chassis, except where otherwise indicated

3. †Use VTVM

| Symbol | Type | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| V101 | 12AU7 | 150 | 6.2† | 0.15 | | | 150 | 6.2† | -0.12 | |
| | | | | | | | 6.3ac | | | |
| V102 | 12AU7 | 150 | -5.8† | 0.54 | | | 150 | 6† | 0.35 | |
| | | | | | | | 6.3ac | | | |
| V103 | 6U8 | 190 | 0 | 150 | 6.3ac | | 150 | 3.6 | 150 | 185 |
| V104 | 12AX7 | 150 | 0 | 1.65 | | | 146 | -148 | -146 | |
| | | | | | | | 6.3ac | | | |
| V105 | QA2 | 150 | 0 | ... | 0 | 150 | ... | 0 | ... | ... |
| V106 | QA2 | 0 | -150 | ... | -150 | 0 | ... | -150 | ... | ... |
| V107 | 5Y3-GT | ... | 200 | ... | -160 | ... | -160 | ... | 200 | ... |
| | | | 5ac | | | | | | | |

TABLE 4-8. RESISTANCE MEASUREMENTS

TYPE 2622 CATHODE-FOLLOWER ADAPTER

NOTES: 1. All resistance measurements taken from tube socket to chassis

2. K = 1000 ohms; M = megohm

| Symbol | Type | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| V101 | 12AU7 | ∞ | 950K | 59K | ∞ | ∞ | ∞ | 950K | 59K | ∞ |
| V102 | 12AU7 | ∞ | 1M | 59K | ∞ | ∞ | ∞ | 1M | 59K | ∞ |
| V103 | 6U8 | ∞ | 1.1M | ∞ | ∞ | ∞ | ∞ | 520 | 10.5K | ∞ |
| V104 | 12AX7 | ∞ | 100K | 10K | ∞ | ∞ | ∞ | 130K | 80K | ∞ |
| V105 | 0A2 | ∞ | 0 | ... | 0 | ∞ | ... | 0 | ... | ... |
| V106 | 0A2 | 0 | 28K | ... | 28K | 0 | ... | 28K | ... | ... |
| V107 | 5Y3-GT | ... | ∞ | ... | 29K | ∞ | 29K | ... | ∞ | ... |

TYPE 343 OR 345 CATHODE RAY OSCILLOGRAPH

COMPONENT PARTS LIST

| Symbol | Part Number | Description |
|---|---|---|
| | BLOWER | |
| B501 | 8100 3501 | motor |
| | 8100 3600 | blade, fan |
| | CAPACITORS (all capacitors are fixed, mica, ±5%, 500 V unless otherwise specified) | |
| C101 | 0305 5130 | 68 uuf |
| C102 | 0303 8470 | 200 uuf, ±10%, 1K V |
| C103 | 0314 0340 | paper, 0.047 uf, ±20%, 200 V |
| C104 | 0314 1820 | paper, 0.1 uf, ±20%, 600 V |
| C105 | 0301 3300 | paper, 20 uf, +100 -10%, 150 V |
| C106 | 0305 5130 | 68 uuf |
| C107 | 0303 8470 | 200 uuf, ±10%, 1K V |
| C108 & C109 | 0300 5150 | variable, ceramic, 7-45 uuf |
| C201 | 0305 5130 | 68 uuf |
| C202 | 0303 8470 | 200 uuf, ±10%, 1K V |
| C203 | 0314 0340 | paper, 0.047 uf, ±20%, 200 V |
| C204 | 0314 1820 | paper, 0.1 uf, ±20%, 600 V |
| C205 | 0301 3300 | electrolytic, 20 uf, +100 -10%, 150 V |
| C206 | 0305 5130 | 68 uuf |
| C207 | 0303 8470 | 200 uuf, ±10%, 1K V |
| C208 & C209 | 0300 5150 | variable, ceramic, 7-45 uuf |
| C301 | 0302 0920 | 62 uuf |
| C303 | 0302 1090 | 330 uuf |
| C304 | 0302 1130 | 470 uuf |
| C305 | 0312 2430 | ceramic, 0.02 uf, +100 -0% |
| C306 | 0315 3750 | ceramic, 0.005 uf, +100 -0% |
| C307 | 0302 9980 | 1000 uuf |
| C308 | 0314 0360 | paper, 0.1 uf, ±20%, 200 V |
| C401 | 0316 9080 | ceramic, 470 uuf, ±20%, 4K V |
| C402 | 0314 6090 | ceramic, 1.5 uuf, ±0.5 uuf, 5K V |
| C404 | 0311 9300 | ceramic, 500 uuf, +50 -20%, 10K V |
| C409 | 0301 9650 | ceramic, 0.01 uf, +80 -20%, 450 V |
| C501 to C504 | 0301 2120 | electrolytic, 40 uf, +40 -20%, 475 V |
| C505 | 0301 9650 | ceramic, 0.01 uf, +80 -20%, 450 V |
| C506 to C509 | 0301 4460 | electrolytic, 125 uf, +50 -10%, 350 V |
| C510 | 0301 9650 | ceramic, 0.01 uf, +80 -20%, 450 V |
| C511 to C515 | 0301 4460 | electrolytic, 125 uf, +50 -10%, 350 V |
| C516 to C518 | 0314 3470 | electrolytic, 100 uf, 150 V |

| Symbol | Part Number | Description |
|---|---|---|
| | RECTIFIERS | |
| CR501 & CR502 | 2600 2110 | selenium, 150 ma |
| CR503 & CR504 | 2600 2100 | selenium, 500 ma |
| CR505 & CR506 | 2600 1350 | selenium, 600 ma |
| | NEON REGULATORS | |
| E101 to E106 | 1200 7161 | ST2-32-1 |
| E108 to E115 | 1200 7161 | ST2-32-1 |
| E117 & E118 | 1200 7161 | ST2-32-1 |
| E201 to E206 | 1200 7161 | ST2-32-1 |
| E208 to E215 | 1200 7161 | ST2-32-1 |
| E217 & E218 | 1200 7161 | ST2-32-1 |
| | FUSES | |
| F501 | 1100 1000 | 3.2 amperes, slow blow |
| F502 | 1100 0820 | 8 amperes |
| | LAMP | |
| I501 | 1200 7700 | NE51, neon, (with built-in resistor for use on 75-250 volts ac or dc) |
| | CONNECTORS (receptacle) | |
| J101 | 0904 0050 | 3 contact, male |
| J102 | 3400 1120 | socket, 8 contact |
| J103 to J106 | 0901 2300 | jack-tip, black |
| J201 | 0904 0050 | 3 contact, male |
| J202 to J205 | 0901 2300 | jack-tip, black |
| J301 | 0904 0050 | 3 contact, male |
| J501 | 0900 0850 | 2 contact, male |
| | INDUCTOR | |
| L601 | 2100 9951 | deflection coil, 8 mh per winding, ±20% |
| | CONNECTORS (plugs) | |
| P102 | 0900 0600 | 8 contact, male |
| P501 | 0900 0850 | 2 contact, female |

| Symbol | Part Number | Description |
|---|---|---|
| | RESISTORS (all resistors are in ohms, fixed, composition, ±5%, 1/2 W unless otherwise specified; K = thousand, M = million) | |
| R101 | 0203 6960 | variable, 100K, 2 W |
| R102 | 0203 3860 | 39K, ±5%, 1 W |
| R103 | 0203 1650 | 100, ±10% |
| R104 | 0203 4650 | 100, ±10%, 1 W |
| R105 | 0203 4770 | 1K, ±10%, 1 W |
| R106 & R107 | 0224 4630 | wire wound, 600, 55 W |
| R108 | 0203 6680 | 6.8K, 2 W |
| R109 | 0203 1270 | 2M |
| R110 | 0203 6110 | 30, 2 W |
| R111 | 0203 3830 | 30K, 1 W |
| R112 | 0103 3330 | variable, 500K, ±20%, 2 W |
| R113 | 0203 3800 | 22K, 1 W |
| R114 | 0203 1000 | 150K |
| R115 | 0203 0880 | 47K |
| R116 | 0210 6190 | wire wound, 7K, 10 W |
| R117 | 0203 1270 | 2M |
| R118 | 0203 6110 | 30, 2 W |
| R119 | 0203 3830 | 30K, 1 W |
| R120 | 0203 1000 | 150K |
| R121 | 0203 6680 | 6.8K, 2 W |
| R122 | 0203 3860 | 39K, 1 W |
| R123 | 0203 1650 | 100, ±10% |
| R124 | 0103 3330 | variable, 500K, ±20%, 2 W |
| R125 | 0203 3800 | 22K, 1 W |
| R126 | 0203 4770 | 1K, ±10%, 1 W |
| R127 | 0224 4630 | wire wound, 600, 55 W |
| R128 | 0203 4650 | 100, ±10%, 1 W |
| R129 | 0224 4630 | wire wound, 600, 55 W |
| R130 A,B | 0103 6250 | variable, 10K/10K, ±20% |
| R131 | 0203 1860 | 5.6K, ±10% |
| R132 & R133 | 0203 4770 | 1K, ±10%, 1 W |
| R134 & R135 | 0203 1650 | 100, ±10% |
| R136 | 0203 1050 | 240K |
| R137 | 0203 0600 | 3.3K |
| R201 | 0203 6960 | variable, 100K, 2 W |
| R202 | 0203 3860 | 39K, 1 W |
| R203 | 0203 1650 | 100, ±10% |
| R204 | 0203 4650 | 100, ±10%, 1 W |
| R205 | 0203 4770 | 1K, ±10%, 1 W |
| R206 & R207 | 0224 4630 | wire wound, 600, 55 W |
| R208 | 0203 6630 | 4.3K, 2 W |
| R209 | 0203 1270 | 2M |
| R210 | 0203 6110 | 30, 2 W |
| R211 | 0203 3830 | 30K, 1 W |
| R212 | 0103 3330 | variable, 500K, ±20%, 2 W |

| Symbol | Part Number | Description |
|---|---|---|
| R213 | 0203 3800 | 22K, 1 W |
| R214 | 0203 1000 | 150K |
| R215 | 0203 0880 | 47K |
| R216 | 0210 6190 | wire wound, 7K, 10 W |
| R217 | 0203 1270 | 2M |
| R218 | 0203 6110 | 30, 2 W |
| R219 | 0203 3830 | 30K, 1 W |
| R220 | 0203 1000 | 150K |
| R221 | 0203 6630 | 4.3K, 2 W |
| R222 | 0203 3860 | 39K, 1 W |
| R223 | 0203 1650 | 100, ±10% |
| R224 | 0103 3330 | variable, 500K, ±20%, 2 W |
| R225 | 0203 3800 | 22K, 1 W |
| R226 | 0203 4770 | 1K, ±10%, 1 W |
| R227 | 0224 4630 | wire wound, 600, 55 W |
| R228 | 0203 4650 | 100, ±10%, 1 W |
| R229 | 0224 4630 | wire wound, 600, 55 W |
| R230 A,B | 0103 6250 | variable, 10K/10K, ±20% |
| R231 | 0203 1860 | 5.6K, ±10% |
| R232 & R233 | 0203 4770 | 1K, ±10%, 1 W |
| R234 & R235 | 0203 1650 | 100, ±10% |
| R236 | 0203 1050 | 240K |
| R237 | 0203 0600 | 3.3K |
| R301 | 0203 1060 | 270K |
| R302 & R303 | 0203 6790 | 20K, 2 W |
| R304 & R305 | 0203 1060 | 270K |
| R306 | 0203 6830 | 30K, 2 W |
| R307 & R308 | 0203 1130 | 510K |
| R309 | 0203 3890 | 51K, 1 W |
| R310 | 0203 4910 | 15K, ±10%, 1 W |
| R311 | 0105 5690 | variable, 250K, ±10% |
| R312 | 0106 2320 | variable, 50K, ±20%, (Type 345) |
| R312 | 0101 1290 | variable, 50K, ±20%, (Type 343) |
| R313 | 0203 6650 | 5.1K, 2 W |
| R314 | 0203 4650 | 100, ±10%, 1 W |
| R315 & R316 | 0203 0990 | 130K |
| R317 | 0107 1026 | variable, 100K, ±20% |
| R401 | 0203 5010 | 100K, ±10%, 1 W |
| R407 | 0203 1020 | 180K |
| R410 | 0203 8250 | 10M, ±10%, 2 W |
| R412 | 0107 1039 | variable, 2.5M, ±25% |
| R413 | 0203 1010 | 160K |
| R414 | 0203 0990 | 130K |
| R415 | 0106 5120 | variable, 5M, ±20%, 2 W |
| R417 | 0210 6240 | wire wound, 13.5K, ±5%, 10 W |
| R419 | 0203 6790 | 20K |
| R420 | 0203 1310 | 3M |
| R421 | 0203 1010 | 160K |
| R422 | 0203 0990 | 130K |
| R423 to R427 | 0203 8250 | 10M, ±10%, 2 W |
| R428 | 0203 5150 | 1.5M, ±10%, 1 W |

| Symbol | Part Number | Description |
|---|---|---|
| R501 & R502 | 0203 6960 | 100K, 2 W |
| R503 | 0224 4570 | wire wound, 100, 55 W |
| R504 | 0107 1039 | variable, 2.5M, ±25% |
| R505 | 0203 2040 | 180K, ±10% |
| R506 | 0222 4110 | wire wound, 15K, 10 W |
| R507 | 0203 1060 | 270K |
| R508 | 0203 1040 | 220K |
| R509 A,B to R511 A,B | 0203 6190 | 62, 2 W, (two in parallel) |
| R512 & R513 | 0203 6960 | 100K, 2 W |
| R514 | 0105 5670 | variable, 50K, ±10% |
| R515 | 0203 0980 | 120K |
| R516 | 0203 2040 | 180K, ±10% |
| R517 | 0222 4110 | wire wound, 15K, 10 W |
| R518 | 0203 3890 | 51K, 1 W |
| R519 | 0203 1040 | 220K |
| R520 A,B to R522 A,B | 0203 6190 | 62, 2 W, (two in parallel) |
| R523 & R24 | 0203 6990 | 100K, 2 W |
| R525 | 0105 5670 | variable, 50K, ±10% |
| R526 | 0203 0980 | 120K |
| R527 | 0210 6210 | wire wound, 10K, 10 W |
| R528 & R529 | 0203 8010 | 100K, ±10%, 2 W |
| R530 & R531 | 0203 6960 | 100K, 2 W |
| R532 | 0224 4570 | wire wound, 100, 55 W |
| | SWITCHES | |
| S301 | 0501 1051 | rotary, 30°, SPDT |
| S401 | 0501 1041 | rotary, 60°, 1P3T |
| S501 | 0500 1320 | toggle, DPST |
| | TRANSFORMERS | |
| T401 | 2000 7231 | radio frequency |
| T501 | 2000 7221 | power |
| T502 | 2000 9901 | power |
| | TUBES | |
| V101 & V102 | 2500 0050 | 6AU6 |
| V103 | 2500 8560 | 6BK7-A |
| V104 to V107 | 2500 9440 | 6CD6-GA |
| V201 & V202 | 2500 0050 | 6AU6 |
| V203 | 2500 8560 | 6BK7-A |
| V204 to V207 | 2500 9440 | 6CD6-GA |
| V301 | 2500 0130 | 12AU7 |
| V302 | 2500 7310 | 6U8 |

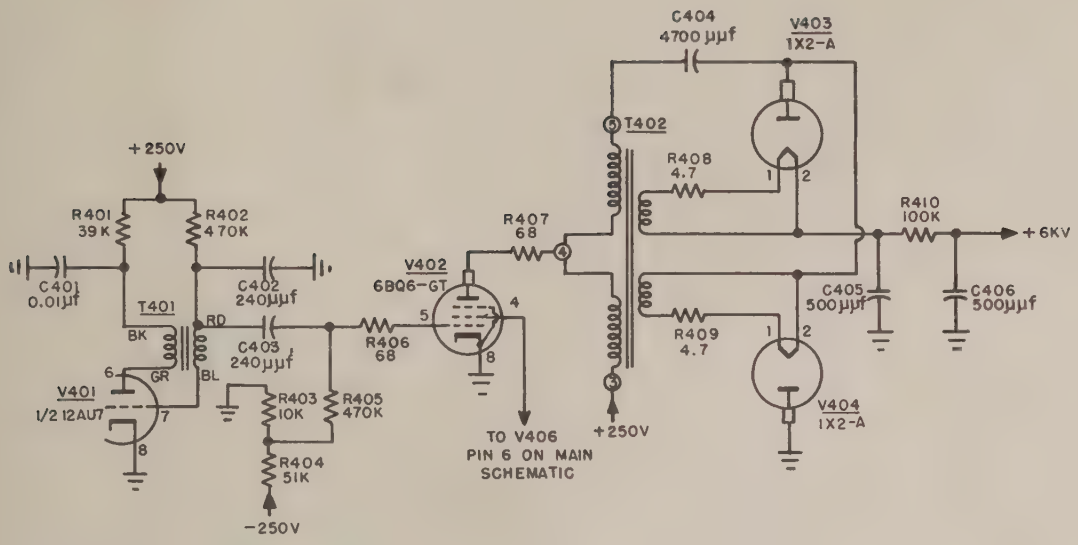
| Symbol | Part Number | Description |
|---|---|---|
| V401 | 2500 9900 | 17LP4 (Type 343) |
| V401 | 2500 7720 | 21FP4A (Type 345) |
| V402 | 2500 6490 | 1X2-A |
| V403 | 2500 2770 | 6AU5-GT |
| V405 | 2500 6490 | 1X2-A |
| V406 | 2500 7820 | 6CL6 |
| V501 | 2500 9540 | CH1068 |
| V502 | 2500 0360 | OB2 |
| V503 | 2500 0050 | 6AU6 |
| V504 | 2500 0360 | OB2 |
| V505 | 2500 0050 | 6AU6 |
| V506 | 2500 9540 | CH1068 |

## TYPE 2622 CATHODE-FOLLOWER ADAPTER

### COMPONENT PARTS LIST

| Symbol | Part Number | Description |
|---|---|---|
| | CAPACITORS (all capacitors are fixed, ceramic, 500 V unless otherwise specified) | |
| C101 | 0300 3070 | 4-30 uuf |
| C102 & C103 | 0302 0400 | mica, 56 uuf, ±10% |
| C104 | 0300 3070 | 4-30 uuf |
| C105 | 0312 2700 | 0.01 uf, +100 -0% |
| C106 | 0300 3070 | 4-30 uuf |
| C107 & C108 | 0302 0400 | mica, 56 uuf, ±10% |
| C109 | 0300 3070 | 4-30 uuf |
| C110 to C112 | 0312 2700 | 0.01 uf, +100 -0% |
| C113 to C116 | 0314 0360 | paper, 0.1 uf, ±20%, 200 V |
| C117 & C118 | 0312 2700 | 0.01 uf, +100 -0% |
| C119 A,B | 0316 4380 | electrolytic, 30/10 uf, +75 -0%, 450 V |
| | FUSE | |
| F101 | 1100 0740 | 0.5 ampere |
| | LAMP | |
| I101 | 1200 7750 | NE51, neon, (with built-in resistor for use on 75-250 volts ac or dc) |
| | CONNECTORS (receptacle) | |
| J101 to J103 | 0904 0050 | 3 contact, male |
| | INDUCTOR | |
| L101 | 2101 0220 | fixed, 4.5 h |
| | RESISTORS (all resistors are in ohms, fixed, composition, ±5%, 1/2 unless otherwise specified; K = 1000 ohms, M = megohm) | |
| R101 | 0223 7680 | film, 4M, ±1% |
| R102 & R103 | 0223 7540 | film, 1M, ±1% |
| R104 | 0223 7680 | film, 4M, ±1% |
| R105 | 0103 3300 | variable, 50K, ±20%, 2 W |
| R106 & R107 | 0203 3890 | 51K, 1 W |
| R109 | 0103 3300 | variable, 50K, ±20%, 2 W |
| R110 | 0223 7680 | film, 4M, ±1% |

| Symbol | Part Number | Description |
|---|---|---|
| R111 & R112 | 0203 7540 | film, 1M, ±1% |
| R113 | 0203 7680 | film, 4M, ±1% |
| R114 | 0103 3300 | variable, 50K, ±20%, 2 W |
| R115 & R116 | 0203 3890 | 51K, 1 W |
| R118 | 0103 3300 | variable, 50K, ±20%, 2 W |
| R119 | 0203 3740 | 12K, 1 W |
| R120 | 0203 0960 | 100K |
| R121 | 0203 3410 | 510, 1 W |
| R122 | 0203 6720 | 10K, 2 W |
| R123 | 0203 3720 | 10K, 1 W |
| R124 | 0203 3870 | 43K, 1 W |
| R125 | 0203 0960 | 100K |
| R126 | 0203 3890 | 51K, 1 W |
| R127 | 0203 0960 | 100K |
| R128 | 0203 6720 | 10K, 2 W |
| R129 | 0210 7830 | wire wound, 750, 10 W |
| | SWITCHES | |
| S101 | 0500 1130 | toggle, SPST |
| S102 | 0500 0050 | rotary, 1P2T |
| | TRANSFORMER | |
| T101 | 2001 0100 | power |
| | TUBES | |
| V101 & V102 | 2500 0130 | 12AU7 |
| V103 | 2500 7310 | 6U8 |
| V104 | 2500 1500 | 12AX7 |
| V105 & V106 | 2500 0300 | 0A2 |
| V107 | 2500 0220 | 5Y3-GT |
| | CABLE | |
| W101 | 5001 5040 | power |

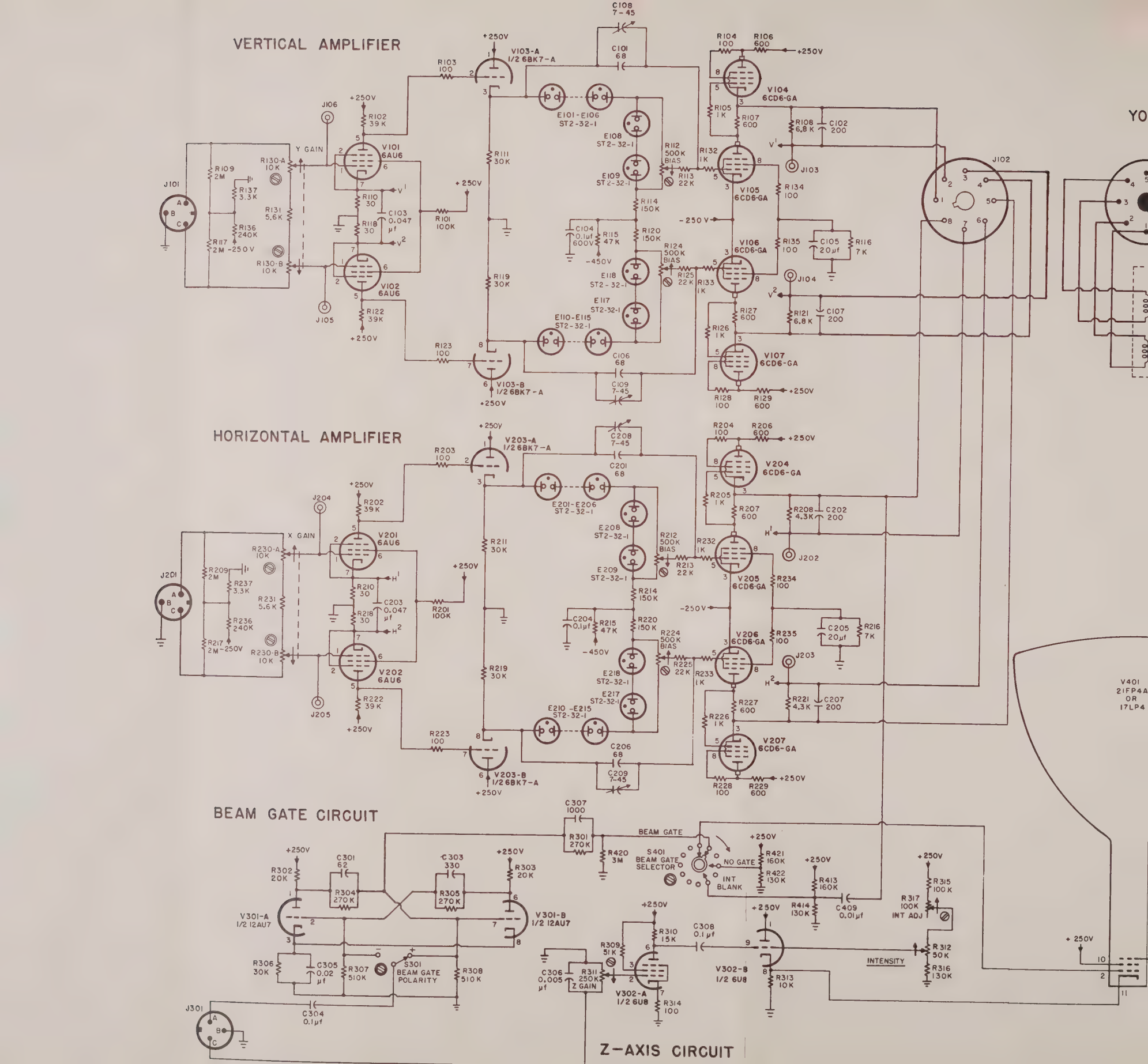


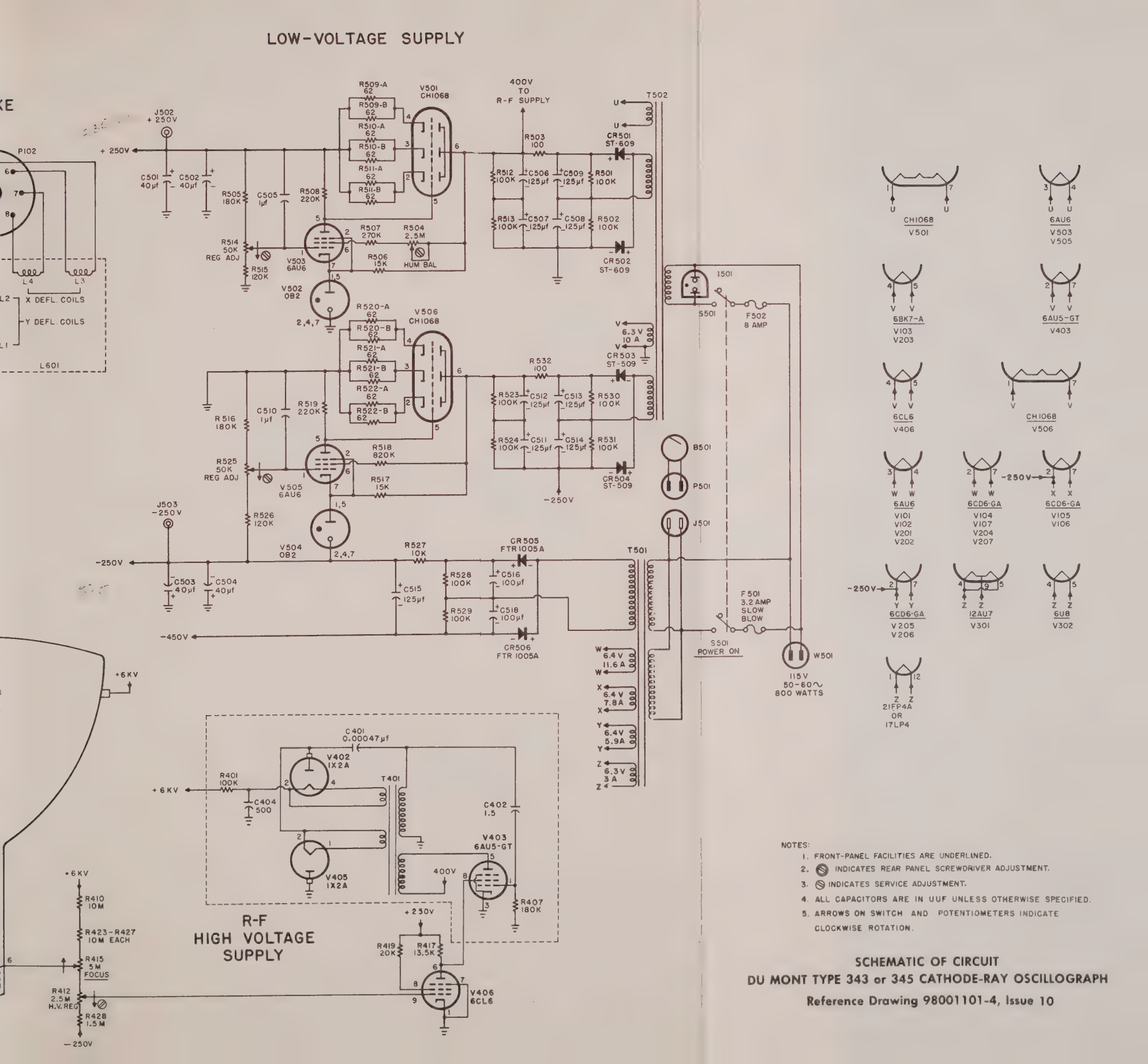

HIGH-VOLTAGE POWER SUPPLY SCHEMATIC

( USED ONLY IN TYPE 345 CRO BEARING SERIAL NUMBERS 1Q01 THRU 1Q35)

COMPONENT PARTS LIST

| Symbol | Part Number | Description |
|---|---|---|
| | CAPACITORS (fixed) | |
| C401 | 0301 9650 | ceramic, 0.01 uf, +80 -20%, 450 V |
| C402 | 0302 1460 | mica, 240 uuf, ±5%, 500 V |
| C403 | 0301 9650 | ceramic, 0.01 uf, +80 -20%, 450 V |
| C404 | 0311 4860 | paper, 4700 uuf, ±20%, 500 V |
| C405 & C406 | 0311 9300 | ceramic, 500 uuf, +50 -20%, 10K V |
| | RESISTORS (all resistors are in ohms, fixed, composition, ±10%, 1/2 W unless otherwise specified; K = 1000 ohms) | |
| R401 | 0203 4960 | 39K, 1 W |
| R402 | 0203 2090 | 470K |
| R403 | 0203 1890 | 10K |
| R404 | 0203 3890 | 51K, ±5%, 1 W |
| R405 | 0203 2090 | 470K |
| R406 & R407 | 0203 1630 | 68 |
| R408 & R409 | 0210 0810 | wire wound, 4.7 |
| R410 | 0203 5010 | 100K, 1 W |
| | TRANSFORMERS | |
| T401 | 2000 5591 | blocking oscillator, 30 kc |
| T402 | 2000 7092 | high voltage |
| | TUBES | |
| V401 | 2500 0130 | 12AU7 |
| V402 | 2500 1830 | 6BQ6-GT |
| V403 & V404 | 2500 6490 | 1X2-A |

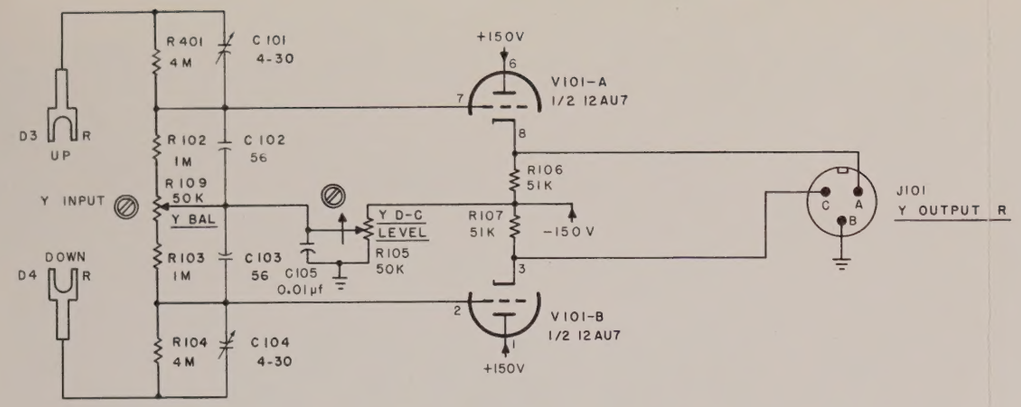

VERTICAL AMPLIFIER
HORIZONTAL AMPLIFIER
BEAM GATE CIRCUIT
Z-AXIS CIRCUIT
V101 6AU6
V102 6AU6
V103-A 1/2 6BK7-A
V103-B 1/2 6BK7-A
V104 6CD6-GA
V105 6CD6-GA
V106 6CD6-GA
V107 6CD6-GA
V201 6AU6
V202 6AU6
V203-A 1/2 6BK7-A
V203-B 1/2 6BK7-A
V204 6CD6-GA
V205 6CD6-GA
V206 6CD6-GA
V207 6CD6-GA
V301-A 1/2 12AU7
V301-B 1/2 12AU7
V302-A 1/2 6U8
V302-B 1/2 6U8
V401 21FP4A OR 17LP4
Y GAIN
X GAIN
BEAM GATE
BEAM GATE SELECTOR
NO GATE
INT BLANK
BEAM GATE POLARITY
Z GAIN
INTENSITY
INT ADJ
+250V
-250V
-450V

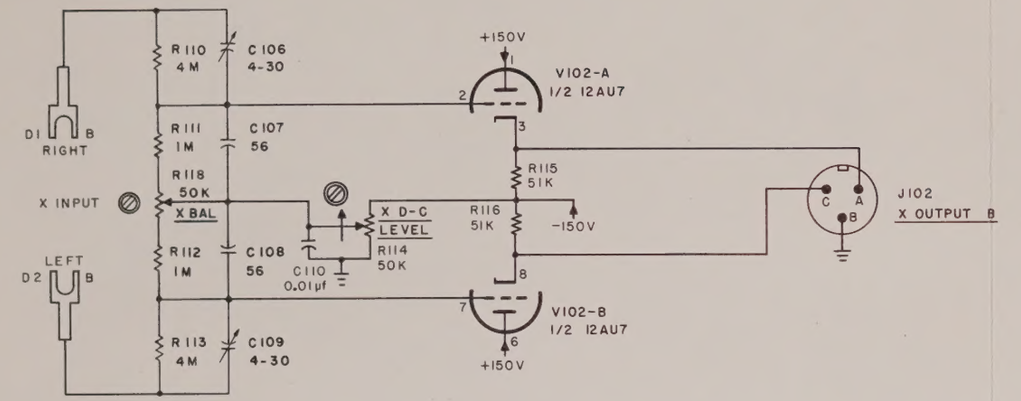


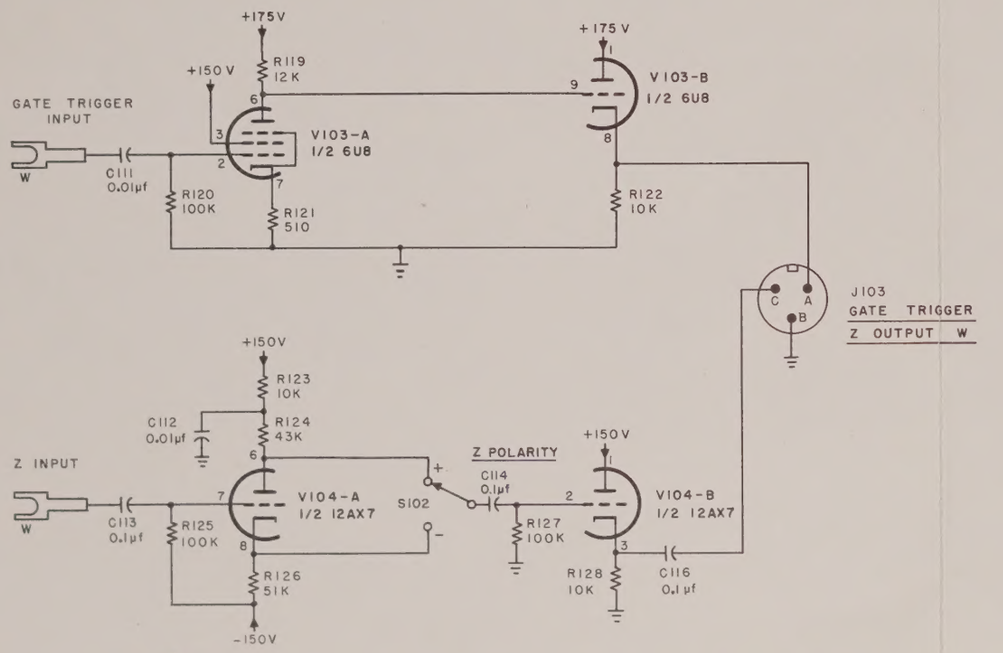

NOTES:

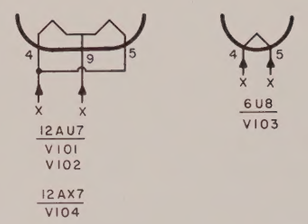
1. FRONT-PANEL FACILITIES ARE UNDERLINED.
2. ⊘ INDICATES REAR PANEL SCREWDRIVER ADJUSTMENT.
3. ⊘ INDICATES SERVICE ADJUSTMENT.
4. ALL CAPACITORS ARE IN UUF UNLESS OTHERWISE SPECIFIED.
5. ARROWS ON SWITCH AND POTENTIOMETERS INDICATE CLOCKWISE ROTATION.

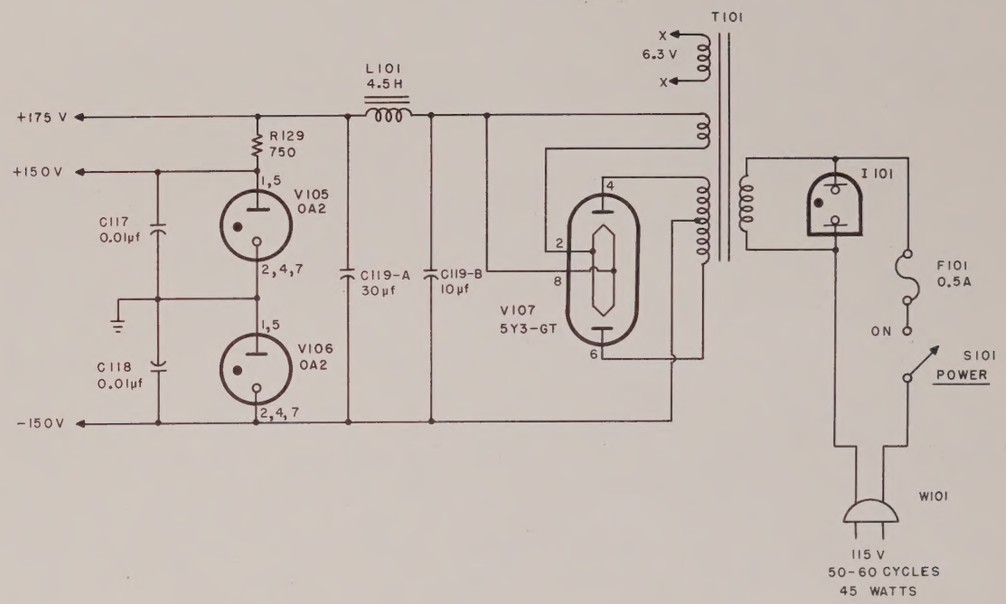
**SCHEMATIC OF CIRCUIT**
**DU MONT TYPE 343 or 345 CATHODE-RAY OSCILLOGRAPH**
**Reference Drawing 98001101-4, Issue 10**




NOTES:

1. ⊘ INDICATES FRONT-PANEL SCREWDRIVER ADJUSTMENT.
2. ALL FRONT-PANEL FACILITIES ARE UNDERLINED.
3. ARROWS ON POTENTIOMETERS INDICATE CLOCKWISE ROTATION.
4. CAPACITORS ARE IN µµf UNLESS OTHERWISE SPECIFIED.

## SCHEMATIC OF CIRCUIT
## DU MONT TYPE 2622 CATHODE-FOLLOWER ADAPTER

Reference Drawing 98001111-4, Issue 5

# WARRANTY AND SERVICE NOTICE
## for
## Industrial Type Cathode-ray Tubes and Instruments

### DU MONT INSTRUMENTS

Each instrument manufactured by the Technical Products Division of Allen B. Du Mont Laboratories, Inc., is guaranteed to equal or exceed its published performance specifications. It is further guaranteed against defective materials (other than the cathode-ray tube) and workmanship for a period of one year from delivery date. Any defective instrument or an instrument that does not meet or exceed our specifications will, upon inspection by us, be repaired or replaced at our discretion should such defect appear within the guarantee period.

To register this guarantee, the enclosed guarantee card must be properly filled out and mailed to the factory immediately upon receipt of the equipment. Complete information is necessary. BOTH THE TYPE NUMBER AND THE SERIAL NUMBER OF THE INSTRUMENT MUST BE GIVEN ON THIS CARD.

Instruments must be examined immediately upon receipt, since claims for damage in transit will not be honored by the carrier unless prompt action is taken.

### DU MONT CATHODE-RAY TUBES

Industrial type cathode-ray tubes manufactured by Allen B. Du Mont Laboratories, Inc., are guaranteed for 1000 hours of operation or for a six-month period from date of shipment, whichever expires first. Adjustments will be made on the merit of each individual claim because of the widely varying applications to which such tubes are subjected, and a tube which becomes defective during the guarantee period will be replaced ONLY AFTER INSPECTION AT THE FACTORY. Cathode-ray tubes returned under the guarantee, must be shipped with transportation paid.

### BURNED-OUT HEATERS AND BROKEN GLASS ARE NOT COVERED BY THE TUBE GUARANTEE

To register a tube guarantee, the guarantee card enclosed with the tube must be filled out properly and mailed to the factory immediately upon receipt of the equipment. Complete information is necessary. TYPE NUMBER AND SERIAL NUMBER OF THE CATHODE-RAY TUBE MUST BE INCLUDED. The serial number of the tube will be found either on the glass stem of the electron-gun structure or on the bulb near the Du Mont brand. Tubes must be examined immediately upon receipt, since claims for damage in transit will not be honored by the carrier unless prompt action is taken.

### CHANGES IN SPECIFICATIONS

The right is reserved to change the published specifications of equipment at any time and to furnish merchandise in accordance with current specifications without incurring any liability to modify equipment previously sold, or to supply new equipment in accordance with earlier specifications excepting under the classification of special apparatus.

### SERVICE

In order to insure factory service under our guarantees, the guarantee cards enclosed with all instruments and tubes must be properly filled out and returned. In all cases where service or adjustment is requested, please write first to the factory giving complete information concerning the nature of the failure and describing the manner in which the equipment was used when failure occurred. THE TYPE NUMBER AND SERIAL NUMBER of the equipment must also be given. In this way, much time can be saved and unnecessary inconvenience often avoided. When writing in this respect, address:

**Allen B. Du Mont Laboratories, Inc.**
*Technical Products Division*
760 Bloomfield Avenue, Clifton, New Jersey

The Technical Products Division will then send to the customer, the written procedure for sending the instrument back to the factory. All equipment should be packed and shipped in accordance with this procedure; and identification tags should be attached to each tube or instrument.

### REPLACEMENT PARTS

If it is necessary to order a replacement component from the factory, always give the type number and serial number of the instrument and refer to the component by its symbol designation and description on the circuit schematic. This will help to expedite service.

DUMONT

Additional copies of this manual may be secured at a cost of two dollars each or twenty dollars per dozen copies; postpaid in the United States of America only.

**Allen B. Du Mont Laboratories, Inc.**

**TECHNICAL PRODUCTS DIVISION**

**760 BLOOMFIELD AVENUE, CLIFTON, NEW JERSEY**